NEEDS ASSESSMENT OF AGRICULTURAL, ENVIRONMENTAL, AND SOCIAL SYSTEMS OF SMALL FARMERS IN CHIMALTENANGO, GUATEMALA

A Thesis

by

CAROLINA OLEAS

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2009

Major Subject: Agricultural Leadership, Education, and Communications

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Approved by:

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	Glen C. Shinn
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ABSTRACT

Needs Assessment of Agricultural, Environmental, and Social Systems of Small Farmers in Chimaltenango, Guatemala. (December 2009)

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Co-Chairs of Advisory Committee: Dr. Kim E. Dooley
Dr. Glen C. Shinn

Providing support for the agricultural development of small farmers is the main goal of the project Agriculture in Guatemala: Technology, Education and Commercialization (AGTEC). To accomplish this it is necessary, to identify the characteristics and needs of participants, as well as their environmental, social, and farming conditions. Through this study, two case studies were conducted to identify and analyze the context of small farmers of the region. This research study used qualitative and participative methods, such as interviews, focus groups, and observation, to gather data about the participants' thoughts and opinions concerning their situations.

The case study systemically gathered information about the conditions and needs of small farmers to provide a better understanding of the people and their interactions within the farm systems. This needs assessment showed how the farmers' decisions about adoption are related to their interactions on their farms. Therefore, this study analyzed the system, as a whole, to identify priorities among different critical components that will provide optimum results for beneficiaries. These priorities will

allow the identification of appropriate technologies that will satisfy the needs of small farmers according to their local, cultural, and economic conditions.

The appropriate technologies need to be diffused among the farmers for adoption. Rogers (2003) observed that technologies that are diffused by opinion leaders are adopted by their peers. Thus, the second case study analyzed the social networks and their leaders to observe their potential to support the diffusion process of technologies. The study revealed the presence of diverse social networks, one provided by the political structure, others based on organized groups of farmers and other informal networks formed by independent farmers. Data also showed that opinion leaders have desired roles and characteristics among their networks. Therefore diffusion of innovations through formal and non-formal leaders represents a promising strategy as they are recognized and respected by peers. The diffusion of innovations through opinion leaders promotes the active participation of local members, validates the innovations, and sustains adoption over time. Therefore, the analysis of the social networks and selection of opinion leaders supports the diffusion process of the AGTEC project in Chimaltenango, Guatemala.

DEDICATION

I dedicate this thesis to the memory of Dr. Norman Borlaug, leader of the Green Revolution, who devoted his life to develop agricultural technologies to save the world from hunger.

ACKNOWLEDGEMENTS

I would like to thank all my family and my boyfriend for their patience and love during this process. Their constant support has always encouraged me to do the best I can and get all my dreams accomplished.

I would like to express my gratitude to my committee co-chairs, Dr. Dooley and Dr. Shinn, and my committee member, Dr. Giusti, for their guidance and support throughout the course of this research.

My gratitude is extended to the Bourlaug Institute for giving me the opportunity to collaborate with the AGTEC project and for facilitating activities to conduct the field research. I would also like to thank the staff members of the project who supported the research and the farmers from Chimaltenango who were willing to participate in the study by sharing their stories and goals.

ACRONYMS AND OPERATIONAL DEFINITIONS

Acronyms

AGTEC	Agriculture in Guatemala: Technology, Education, Commercialization
BI	Borlaug Institute for International Agricultural Development
TAR	Texas AgriLife Research
FRS	Farm Research System
PRA	Participatory Rural Appraisal

Operational Definitions

Appropriate technology	"Any object, process, ideas, or practice that satisfies human needs" (Hazeltine & Bull, 2003, p. 3). They are design based on the beneficiaries' needs to fit the local, cultural, and economical situations through the use of available resources (Hazeltine & Bull, 2003).
Change agent	Individual who "facilitate the flow of innovations from a change agency to an audience of clients; to be effective the innovations must be selected to match client's needs" (Roger, 2003, p. 368).
Diffusion	"Process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p. 11).
Gini coefficient	Economic index which measures the equality in the distribution of income among the population of a country,

	where 0 implies perfect equality and 100 implies perfect inequality (Earthtrends, 2003).
Innovation	"An idea, practice, or object that is perceived as new by an individual or group of individuals" (Rogers, 2003, p. 12)
Needs assessment	Systematic documentation that "involves the identification, definition and prioritizing of farmers' problems and opportunities that appear susceptible to intervention" (Dorwand, Shepherd, & Wolmer, 1997, p. 243).
Opinion leaders	Heterophilous individuals who "influence others' attitudes or change behavior informally in a desired way with relative frequency" (Rogers, 2003, p. 388).
Participation	"A process through which stakeholders influence and share control over development initiatives, decisions, and resources that affect them" (World Bank, 1996, p. 3).
Social system/network	"A set of interrelated units that are engaged in joint problem-solving to accomplish a common goal" (Rogers, 2003, p. 23).
Sustainable development	"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987, p. 24).

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INTRODUCTION

Statement of the Problem

In 2000, the United Nations joined 190 countries in ten regions of the world to commit to a global collective effort which defined eight Millennium Development Goals for reducing the world's absolute poverty by half by 2015. Governments from developing countries, the international community, the private sector, and the civil society of both developing and developed countries have designed and implemented different strategies and projects to achieve this common goal (United Nations, 2009). In the area of agricultural development, one common strategy used to reduce poverty in rural areas is encouraging farmers to improve the management of agricultural systems by transferring knowledge and innovations through training. Some of the recurrent challenges we face include:

- What agricultural practices are appropriate to the social and economical conditions of small farmers?
- How to identify and develop appropriate agricultural innovations?
- Will training improve the farmers' agricultural systems?
- Who are the farmers most in need of training?
- How do we diffuse innovations among farmers for sustained adoption?

This thesis follows the style and format of the Journal of International Agricultural and Extension Education.

This study identified participatory strategies to select beneficiaries who will support the diffusion process through time. It also identified the conditions and needs of a group of farmers to analyze their situations and define priority areas of work. These priorities will support the identification of appropriate innovations that will fulfill the beneficiaries' needs to reach a self-sustained rate of adoption through time.

Background Information

Countries of Latin America, such as Guatemala, have immense diversity among their populations. Aspects, such as the socio-economic conditions of individuals, vary according to the historical and cultural backgrounds, as well as the environmental situations of every country. In the case of Guatemala, the population is made up of two ethnic groups: the Indigenous and the Ladinos. The indigenous people are descendants of the Mayans and are sub divided into different groups according to their location and language. The other group, the Ladinos, consider themselves as the national Guatemalan culture. Regardless of their ethnicity, Ladinos mainly speak Spanish (Pebley & Goldman, 1995).

An important percentage of Guatemala's population depends on agriculture, either as "self-employed farmers, as farm laborers, or as workers on plantations" (Pebley & Goldman, 1995, p. 8). As a result, rural areas in Guatemala, as well as other countries of Latin America, have gone through a "major structural transformation to an economy at least partly based on markets, cash and wages" (Pebley & Goldman 1995, p. 8) during the past 20 years.

Guatemala presents an unequal distribution of income and resources among the populations. Inequality is measured by an economic index called the Gini coefficient which measures the equality in the distribution of income among the population of a country, where 0 implies perfect equality and 100 implies perfect inequality. In the case of Guatemala, it presents a Gini Coefficient of 56, where the richest 20% of the population earns 60.6% of the total income, while the poorest 20% earns just 3.8% of the total income (Earthtrends, 2003). Therefore it is important to implement development strategies that will reduce or eliminate the big gap between social and economic classes.

Guatemala presents diverse and complex farm systems, cultures and ecological conditions that need to be studied and analyzed to identify and select development projects that support the social and economic development of farmers in rural areas. Therefore, it is important to conduct a needs assessment to identify the individuals' situations and their needs with aims to develop appropriate methodologies and practices that will fit their unique situations.

The introduction and diffusion of appropriate agricultural innovations can be done through recognized opinion leaders who validate the innovations and support the diffusion process among other small farmers. The adoption of appropriate agricultural innovation through known socials networks will be sustained through time.

Chimaltenango, Guatemala

Chimaltenango is a region of Guatemala that has a land area of 1979 km² and a population of 562,555 inhabitants (Department of Education of Guatemala, 2007). The main languages of the region are Kakchikel and Spanish. It is made up of 16

municipalities, including Chimaltenango, San Jose Poaquil, San Martin Jilotepeque, San Juan Comalapa, Santa Apolonia, Tecpan Guatemala, Patzun, Pochuta, Patzicia, Santa Cruz Balanya, Acatenango, Yepocopa, San Andres Itzapa, Parramos, Zaragoza, and El Tejar (Municipal Information Service, 2009). These municipalities have been organized into four areas according to their main economic activity. The agricultural zone is the biggest area in size (it includes the municipalities of Tecpan, Patzun, Pazticia, Santa Cruz Balanya, Pochuta, Acatenango, Yepocapa), followed by a touristic area (includes the north-east municipalities of San Jose Poaquil, San Martin Jilotepque, San Juan Comalapa, Santa Apolonia), and a industrial zone (Chimaltenango, San Andres Itzapa, Parramos, Zaragoza, El Tejar) (Departmental Counsel for Development, 2007).

Agriculture in Guatemala: Technology, Education, Commercialization (AGTEC) Project

The AGTEC project is an agricultural development project implemented by Borlaug Institute (BI) and Texas AgriLife Research. AGTEC will benefit 10,000 farmers in five regions of Guatemala over a three-year period. The project's main goal is to improve the small farmers' agricultural systems. AGTEC has three specific objectives: (a) to improve the agricultural systems and management techniques through the transfer of technology, (b) to provide training about agricultural production and processing techniques to small farmers, students, and change agents, and (c) to provide agricultural marketing and business development services to farmers. The project started its implementation in June 2009 in the region of Chimaltenango and intends to expand to other regions, such as San Juan Sacatepequez, Peten, Izabal, and selected areas from the tropical coast lowlands of Escuintla.

The implementation of the AGTEC is carried by a team of seven local professionals or change agents who also monitor and evaluate the different components. Some of the main challenges that the project faces are the identification and selection of beneficiaries and the selection of appropriate technologies to be transferred to facilitate the process of change among farmers of Guatemala.

As mentioned before one of the specific objectives of the project is the transfer of technology. This component is a process which is carried by the change agents to the farmers. The process starts when certain groups of small farmers are contacted by the technicians. Technicians establish a relationship with the farmers to gather information about their conditions and needs. Later, the technicians and the farmers will define and negotiate the technology to be transferred and the training topics to be presented to the farmers. The project provides the resources to apply the technologies at the farmers' lands. The farmers will implement the technology with the technical assistance of the technicians, who will follow up the process. The goal is that farmers will adopt the technology and maintain it by themselves to improve their agricultural production.

Conceptual Framework

The Millennium Development Goals, target and indicators were defined to reduce poverty in a sustainable development context. This context recognizes the importance for growth, poverty reduction, and sustainable development to occur simultaneously. The United Nation (1987) defined this term as "development that meets the needs of the present without compromising the ability of future generations to meet

their own needs" (p. 24). As a result, needs of poor populations have to be satisfied through the appropriate use of natural and economical resources.

Needs assessments are effective at identifying the current social, cultural, and economical conditions of individuals. This planning tool reveals the needs and problems of a group of individuals, community, or organization. As a result, needs provide the basis to develop appropriate innovations that will respond to the individuals' conditions. Diffusion of appropriate innovations among a social network through opinion leaders will allow sustained adoption over time.

Needs Assessment

The needs of a community, area, or country should be the starting point for the design of a development project. Needs are systematically explored through the application of needs assessment. All the needs or problems are then analyzed to define priorities and guide the development of the project's purposes and objectives (Rouda & Kusy, 1995). Therefore, needs assessments are recognized by the World Health Organization, or WHO, (2000) as "a tool for program planning" (p. 7).

The needs assessment is a management tool that can be used as a budgeting and monitoring device. It helps direct managers to wisely invest funds in activities and services that will have a real impact in the communities they are serving (Rouda & Kusy, 1995). Additionally, the needs assessment will serve as a baseline study to measure the project's social and economical impact on the beneficiaries.

A needs assessment allows the identification and analysis of the gap between the current situation and the desired situation in terms of knowledge, skills, technologies, or

services. Then, the needs assessment defines the priorities among all the needs. The priorities will be influenced by the project's nature, the time for implementation, and the resources available. Based on the prioritized needs, the project will define possible solutions and opportunities (Rouda & Kusy, 1995).

The needs assessment is the start of an active identification of needs to plan the implementation of change. Change should be viewed as a process and not a destination. For this to happen, the transition should be facilitated as a participative process where participants constantly contribute with their observations and recommendations.

Social Systems

Rogers defined a social system as "a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal" (Rogers, 2003, p. 23). This system is made up of units and a structured communication channels to work towards a common goals. As a result, it is important to study the systems and identify the members, their roles, and interactions. These structured systems can be used to diffuse agricultural innovations among farmers.

According to Rogers (2003), innovations are developed to reach critical mass when "enough individuals in a system have adopted an innovation so that the innovation's further rate of adoption becomes self-sustaining" (p. 363). To reach critical mass, certain members that are recognized by others as opinion leaders influenced others for adoption. The identification of opinion leaders in the diffusion process is a key factor for sustained adoption of innovations (Rogers, 2003).

To decrease the socio-economic differences between classes, there is a need to conduct a participative study to select participants from all adopter categories, educational levels, social, and economical classes. Selection of opinion leaders from different groups will support the diffusion of knowledge and innovations among all farmers which will work to decrease socio-economic gaps and, at the same time, work to increase the degree of equality among participants.

Appropriate Innovations

Beneficiaries are considered the clients or consumers of development projects. Therefore, demand-driven projects look for the beneficiaries' input through the needs assessment to develop appropriate innovations. In other words, appropriate innovations are based on the beneficiaries' needs to fit the local, cultural, and economical situations through the use of available resources (Hazeltine & Bull, 2003).

The concept of appropriate technology was recognized in the past by Schumacher (1973) as intermediate technology. He described an intermediate technology as one that is transformed from actual technologies (such as the indigenous agricultural knowledge), that is more productive, simple to use, and capital saving. The final goal of intermediate technology is to fit smoothly into different contexts. Schumacher proposed this concept to develop alternative technologies that would suit the agricultural conditions of developing countries. Conditions from developing countries were different from the ones in developed countries, where the development of technologies was concentrated.

Since the 1970s the development and application of appropriate technologies have been transformed. At the present, the development of appropriate agricultural technologies and practices is achieved by the farmers' involvement during the research period to ensure that all needs and preferences are satisfied (IFAD, 2007). Therefore, an appropriate technology is generated through participatory research where farmers and extension agents generate innovations that address location-specific problems or needs. The needs are a reflection of the social, cultural, and economic conditions of the communities (Rutatora & Mattee, 2001). These innovations, which are considered sustainable, have a sustained adoption over time.

Adoption of Innovations in Developing Countries

Small farmers in agricultural systems of Latin America present complex situations. They depend on semi-subsistence farming systems characterized by insufficient use of local knowledge, unavailable improved technology, and low levels of productivity (Hartwich, Monge, Ampuero, & Soto, 2007).

Small farmers are characterized by low levels of adoption of innovations. Some of the common factors that affect the non-adoption of innovations in developing countries are the lack of credit for investment, limited access to market information, aversion to risk, inadequate farm size, unstructured farm tenure arrangements, insufficient human capital, limited supply of inputs, insufficient machinery, and inappropriate transportation and infrastructure (Feder, Just, & Zilberman, 1985).

Role of Women in Agriculture in Guatemala

The percentage of women in rural areas of Guatemala such as Huehuetenango, is higher than men. This is probably caused by the high rates of migration and armed conflicts. Women in rural area have limited access to education; there is a predominance of women who do not attend to school. The majority of women are “housewives” which include being in charge of all the activities to maintain the house and their children. According to the Food and Agriculture Organization of the United Nations (FAO) and International Plant Genetic Resource Institute (IPGRI) (2002) these activities include food preparation, gathering wood, cleaning the house, care and feeding of domestic animals such as, chicken and pigs, taking care of the children, making craft objects for sale, and “helping” in farm tasks. These farm tasks include certain agricultural activities such as weeding and harvesting in subsistence and cash crops. Even the job of women is not economically recognize, her role is essential for agricultural and nutritional purposes (FAO & IPGRI, 2002).

Purpose of the Study

The purpose of this study was to observe the agricultural situation and analyze the needs of beneficiaries of the AGTEC project of the area of Chimaltenango, Guatemala. This study had two main objectives:

1. Identify the environmental and technical situations of small farmers through a needs assessment; and,
2. Describe the social networks and identify the roles of opinion leaders and their linkages.

This study identified and analyzed the economical, social, technical, and environmental situations of beneficiaries of the AGTEC project to assess their needs and constraints. The analysis of the actual needs lead to the definition of critical factors for production. A better knowledge of the context and priorities of small farmers allowed the identification of appropriate innovations. Appropriate innovations should best fit the beneficiaries' conditions in such a way that adoption will be sustained over time.

To learn about the social networks of participants, networks of various communities of the area of Chimaltenango were observed and analyzed. The goal was to identify key participants and opinion leaders and define their roles, interactions, and links with other community members. These participants served as role models of the adoption of agricultural innovations to their peers. In addition, the key players, through their leadership skills, diffused innovations and information among the peer network.

Research Questions

This study consists of four constructs that identify the farmers' social networks and their needs and perceptions about the transfer of agricultural knowledge through training. The following descriptions tell how each construct contributed to the study's prior objectives:

- Social network- analyze the social network of some communities of the area of Chimaltenango to identify opinion leaders their roles, influence, links, and interactions with other members and small farmers.
- Agricultural knowledge and networks- identify the farmer's receptivity to change. Identify most common agricultural practices and levels of production.

Identify vertical and horizontal sources of knowledge and levels of communication among farmers.

- External and internal factors that affect small farmers- identify physical, biological, social, and economical factors that affect the decision-making process towards the farm system. Analyze problems, opportunities, needs, and goals of small farmers that affect the adoption of agricultural innovations.

Methods

This case study assessed the needs of a group of individuals who were participating in the AGTEC project in Chimaltenango, Guatemala. Due to the nature of the study, the researcher used qualitative methods to, "understand how people make sense of their experiences" (Merriam, 2009, p. 37). Methods, such as individual interviews, focus groups, observation, and journals, were used to gather individuals' opinions about their social networks and their environmental and agricultural situations. In order to conduct this study, the researcher was approved by the International Review Board (IRB) to gather data among individuals about this specific topic (Appendix A).

The researcher used a purposive sample consisting of 19 opinion leaders and small farmers of different communities of the area. Individuals in the sample were identified through network sampling. This type of sampling allowed the researcher to identify a number of key participants who referred the researcher to others that provided rich information to understand the phenomenon (Merriam, 2009).

This study consisted of two case studies. Case studies were used as a method to understand and analyze the complexity of a single case (Stake, 1995), such as the one

presented by small farmers in Guatemala. In addition, the case study research was used as “an experimental inquiry that investigates a contemporary phenomenon in depth and within its real life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used” (Yin, 2009, p. 18).

Merriam (2009) noted that “in qualitative research, interviewing is often the major source of the qualitative data needed for understanding the phenomenon under study” (p. 114). In this case, data were collected through semi-structured interviews. These interviews done to individuals and focus groups were guided by a set of questions (Appendices B & D) with no predetermined order to gather information about the participants’ experiences, opinions, knowledge, and perceptions about the study (Merriam, 2009).

Confidentially of participants was kept by coding the data that were gathered. Codes were used according to the method used to gather the data. In the case of interview an “I” was used and “FG” for focus groups. In addition, a random number was assigned to each participant. Names with own codes were keep in a separate notebook.

Data were transferred from field notes to electronic documents. In addition, the information was translated from Spanish to English. Each word was carefully translated to try to keep the cultural and historical context and background of the statements and interpretations made by participants. Translating information in qualitative research can be a challenge as Ryen (2002) (cited by Lincoln & Gonzalez, 2008) explains “transporting data across cultures continue to face methodological difficulties, problems

understanding local languages and their context, insider-outsider challenges, and issues related to questioning the use of translators" (p. 786). Some of the strategies that the researcher/translator used to reduce loosing the power of words in translation were, ask participants the meaning of certain local vocabulary, ask for more information about the context or situations of when to use those words, and restate their statements in different ways to make sure the main point was cover. Finally, all original interviews and dialogues in Spanish were kept in a notebook were the researcher went back for review when necessary.

Translated data were organized into categories for each article (Appendices C & E). Categories were triangulated and analyzed. In this study, two types of triangulation were used: 1) multiple sources of data were interviewed, and 2) multiple methods of data collection were used to confirm the findings in the different categories.

Data were internally validated by the respondents as they read and approved all the statements and interpretations gathered by the researcher. Another strategy used to reassure external validity and credibility of the data collected was through peer reviews. The sample and categories of the study was reviewed by a colleague from the AGTEC project. Observations and feedback from this review were gathered into a peer debriefing memorandum (Appendix F). Finally, the researcher reassured adequate engagement during data collection by staying in the site for a complete month working and sharing with the participants in different situations and scenarios (Merriam, 2009).

The researcher being the human instrument for data collection for this study brought some advantages and challenges. Being a female Latina brought advantages

during data collection with female participants who trusted the researcher easily and felt comfortable talking about personal needs and situations. Female participants also felt free to talk about their needs to assume leadership positions as the researcher was a female. It might have been different if the researcher was a male. In the other hand, the researcher thought that male participants were not as explicit and detailed in their descriptions as females; this might be caused by gender bias. All these perceptions concur with Lincoln and Gonzalez (2008) who stated “the researcher, as part of the research study, influences the results and their presentation and our appreciation of them” (p. 794).

Data were organized into two research articles. The first article gathered information about the farmers’ conditions and needs through the use of participatory methods. Data were presented as a needs assessment and analyzed to define priorities to develop appropriate technologies for the agricultural development of small farmers. The second article analyzed the socials networks and identified opinion leaders and their roles in the diffusion of innovations among farmers. The two articles are presented in the next two sections.

PARTICIPATORY NEEDS ASSESSMENT OF SMALL FARMERS IN CHIMALTENANGO, GUATEMALA

Introduction

Low rates of adoption plus low levels of involvement by beneficiaries lead international organizations to seek input in the development process by applying participatory needs assessments. Therefore, the role of professionals in a needs assessment is to facilitate an environment where groups of stakeholders share their situations and conditions through dialogues and interviews. This environment provides a space for participants to analyze their needs and define priorities through visual tools such as maps and matrixes (Narayanasamy, 2009). This information serves as the baseline for the design of development strategies and appropriate technological innovations that will satisfy the stakeholders' needs.

Literature Review

The use of participatory approaches to reach development has increased over the last century as a result of shortcomings of previous economic models and development efforts. Three circumstances have contributed to the increased demand for participatory approaches in the planning and acting to reduce poverty worldwide. Ford (2003) recognized three contributing circumstances: (a) the failure of economic models and policies which focused in economic growth and widened inequality among populations, thus accelerating global poverty during the last twenty years; (b) the collapse of states which mainly applied top down strategies and did not solve the economic and social problems or needs of the populations; and, (c) the change in institutional behavior of

international organizations to use participatory approaches based on the demonstrated successes to reduce poverty accomplished by grassroots participatory organizations.

Participation is encouraged to improve the well-being of participants, thus participation in the process is voluntary. World Bank (1996) defined participation in the development process as, “a process through which stakeholders influence and share control over development initiatives and the decision and resources which affect them” (p. 3). The use of participatory principals and methods result in decisions made by participants, more adoption of those decisions, more motivation of the participants and learning of leadership skills (Narayanasamy, 2009).

The Role of Farmers and Extension Agents

Farmers have always had an active role in the development of agriculture. For the last 10,000 years, farmers have interacted with a variety of conditions and species to develop productive systems. Farmers have experimented with native and introduced species to select varieties and breeds that efficiently respond to natural factors such as insects, diseases, and weeds. Biological innovations generated by farmers have greatly contributed to crop and livestock production (Olmstead & Rhode, 2008). Aside from experiments to increase production, farmers have also contributed in the development of processing and storage options. A farmer, as defined by Rhoades (1987), is an individual who constantly interacts and experiments with animal and plant species to increase production levels.

Even though farmers have been active actors of agricultural growth in the past, they have not been included in the decision-making process of development projects.

The non-involvement of farmers in the design of development strategies brought multiple failures. Therefore, participatory approaches and methods were developed as a strategy to encourage farmers' input in the process.

Farmers in participatory approaches have a primary role in the development process. Farmers are also called insiders because they are the source of the local knowledge and information. Some of the roles that farmers perform are to inform, explain, discuss, analyze, plan, monitor, and evaluate (Narayanasamy, 2009). Insiders contribute systematically and constantly to the different stages of the project with rich experiences and skills.

Due to the nature of participatory approaches, researchers and professionals limit their roles as facilitators of the development process. Outsiders, as they are also called, facilitate the "generation of knowledge and analysis and its recognition that local people's own definition of their interest and 'felt needs' is crucial for long term success" (Sutherland, 2002, p. 7). Professionals that facilitate participatory environments should have good listening skills to gather as much information as possible from participants. They should also be flexible to adapt and improvise during the process, and should also be patient to observe without intervening in the process (Narayanasamy, 2009).

Needs Assessment

Needs assessment has been used as a participatory tool for project development. A needs assessment applied in development or research interventions has been defined as systematic documentation of the most relevant needs (Etling & Smith, 1994). Dorwand, Shepherd, and Wolmer (1997) explained that a needs assessment "involves

the identification, definition and prioritizing of farmers' problems and opportunities that appear susceptible to intervention" (p. 243).

A needs assessment can be divided into two phases: the identification of constraints and the evaluation of opportunities. The first phase helps the outsiders to understand the utilization of, and access to, resources. Subsequently, the second phase evaluates and analyzes the opportunities for development to identify appropriate innovations that will make a sustainable use of the local resources available (Dorwand, Shepherd, & Wolmer, 1997). In order to successfully establish rapport and facilitate the discussion and analysis of opportunities among local farmers or insiders, outsiders should use participatory methodologies such as Farm Research Systems (FRS) and Participatory Rural Appraisals (PRA) (Narayanasamy, 2009).

Literature and experiences have recognized needs assessments as a critical stage of project development to effectively respond to local needs. Etling and Smith (1994) recognized that there were still numerous development organizations that do not conduct need assessments or apply them in a superficial manner. For this, they recommended forming a multidisciplinary team, made up of outsiders as well as insiders (local farmers). The team identifies the needs that will serve as the base for planning and ensure in this way the insiders' commitment for implementation (Etling & Smith, 1994).

Farm Research Systems (FRS)

During the 1970's, donors and governments focused their efforts in the implementation of integrated rural development projects. These projects were meant to decrease the income distribution inequalities among populations and improve basic

needs, such as housing and nutrition, for less developed countries. An integrated approach allowed development organizations to improve health, education, and sanitation conditions and, at the same time, allow organizations to realize the diverse and complex needs that rural populations face. Even this was a step forward to reduce poverty as a whole; however, the integrated approach to development showed to be complex and difficult to implement and replicate (Staatz & Eicher, 1998).

Under the integrated rural development era, the Farm Research System (FRS) emerged as an approach to identify "the factors that influence farmers' decisions concerning whether to adopt new varieties and farming practices" (Staatz & Eicher, 1998, p. 23). Additionally, the FRS, according to Shaner, Philipp and Schmehl (1982), was an approach which had the purpose of generating "more appropriate technologies for farmers" (p. 13).

Under this approach, the farm was considered as a whole, where all the biological, ecological, social, economical, and political components and their interactions are important and considered. Farmers' perceptions and expectations are also gathered to learn about their attitudes and behaviors towards innovations (Shaner, Philipp, & Schmehl, 1982). According to Dorward, Shepherd, and Wolmer, the FRS was used as a tool to conduct needs assessments which, taking the form of detailed economical and technical baseline surveys.

The FRS was implemented through systematic contact with farmers to understand their situations in terms of the environment and the farm system. Information gathered from farmers allowed professionals and researchers to understand and analyze

the system for the team's effort to be more productive. Also, it served to identify major components of the system and their internal and external interactions (Shaner, Philipp, & Schmehl, 1982).

Information about the environment is essential to understand its conditions and constraints. The constraints determine the limits of the system, with the purpose of not proposing technologies that can compromise the natural resources. In addition, environmental conditions determine the farming strategies that can succeed. Normally, farmers have little control of these factors, but they are essential in determining the farm system. The most common environmental factors considered in a farm research system are the physical, biological, economical, and social conditions related to the farm system (Shaner, Philipp, & Schmehl, 1982).

Besides the environmental factors, the FRS also identifies the farming system as a whole. The main component of the system is the farmer; thus, understating his/her general characteristics, knowledge, beliefs, attitudes, and behaviors towards the adoption of agricultural techniques is most important. Another component of the farm system is the farmers' goals, which will allow the identification of their needs in the long run. Finally, resources, such as land, labor, and capital, are also considered as part of the system. Factors in the farm system are considered to be under the farmers' control (Shaner, Philipp, & Schmehl, 1982).

Participatory Rural Appraisal (PRA)

Chamber (1992) states that participatory approaches, such as the PRA, were developed for "local people to share, enhance and analyze their knowledge of life and

conditions, to plan and to act" (as cited in Sutherland, 2002, p. 6). Participatory Rural Appraisal promotes systematic participation, interactive problem analysis, and interdisciplinary problem-solving (Etling & Smith, 1994). In other words, PRA uses different methods to promote a dynamic environment where participants analyze their needs and resources with a problem-solving perspective.

The PRA has borrowed methods from other "field-based and people-oriented participatory approaches" (Narayanasamy, 2009, p. 25) to facilitate the process of planning, acting, monitoring, and evaluating by people. Two methods that are commonly used to gather the conditions of participants are the interview and dialogue. Semi-structured interviews are open and flexible dialogues that allow participants and professionals to interact through different topics. These types of interviews are optimal to gather a wide range of data relevant to a specific study (Narayanasamy, 2009).

PRA also promotes the systematic analysis of problems through the use of different tools. The use of matrixes facilitates the prioritization of components on a single issue. This participative exercise provides a space to a group of individuals to identify options for actions, thus being an organizational tool. It also allows participants to recognize the resources available for the priorities recognized (Narayanasamy, 2009).

Appropriate Technology Innovations

According to Hazeltine and Bull (2003) an appropriate technology is "any object, process, ideas, or practice that satisfies human needs" (p. 3). It is appropriate when it is "compatible with local, cultural and economic conditions, and utilizes locally available materials and energy resources, with tools and processes maintained and operationally

controlled by the local population" (p. 3). Thus the development of appropriate technologies has to be based on beneficiaries' needs that are gathered through participatory assessments.

Characteristics of an innovation

Adoption is the primary goal of any innovation. Rogers describes the rate of adoption as "the relative speed with which an innovation is adopted by members of a social system" (Rogers, 2003, p. 265). The rate of adoption is predicted by the perception of the attributes of an innovation. These attributes are relative advantage, compatibility, complexity, trialability, and observality (Rogers, 2003). Relative advantage refers to the degree that an innovation is considered better by the members of a system. Compatibility of an innovation is described by Rogers (2003) as "the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (p. 266). Complexity refers to the level of difficulty an innovation has to be understood or used by the adopters. Trialability is the level to which and innovation can be experimented by members of a system. Finally, observability is defined as, "the degree to which the results of an innovation are visible to others" (Rogers, 2003, p. 266).

Background on the Study Context

Various groups of small farmers are currently receiving training and technology transfer of improved agricultural practices as part of the AGTEC (Agriculture in Guatemala: Technology, Education, Commercialization) project. They live in the area of Chimaltenango and have agriculture as their main source of income. These farmers own,

or rent, small to medium pieces of land to produce crops, such as vegetables, for local and national markets and family consumption. Most small farmers have low levels of production and use basic agricultural practices to cultivate their products. This is the reason why they look for technical assistance about innovations that will increase their agricultural production and, therefore, their income.

This case study identified the farmers' conditions, needs, and constraints through the use of participatory methods.

Purpose and Research Objectives

The purpose of this study was to understand the conditions and needs of a group of small farmers from Chimaltenango who were participating in the AGTEC project's activities. The specific objectives were as follows:

(a) Identify and describe the characteristics and agricultural conditions of a group of farmers through the use of FRS methods; and

(b) Analyze the needs of this group of farmers through the use of PRA methods.

FRS methods provide a complete analysis of the farm system which includes the environmental factors as well as the farmers' characteristics. This integrated perspective allows the identification and analysis of all the components the farm to view the system as a whole. FRS methods were used in order to provide a whole perspective of the needs of small farmers.

PRA methods were used to gather the data to allow participants to fully communicate their situations and be able externalize their needs. Data collected where organized in the following needs assessment.

Methods

Information for this case study was gathered through qualitative research methods. Semi-structured interviews, dialogues, and observations were used to understand the farmer's environmental conditions and the different farm systems' characteristics.

The purposive sample for this case study was made up 16 small farmers from the region of Chimaltenango, Guatemala. They participated in training activities and transfer of technology projects from the AGTEC project implemented by the Borlaug Institute. Participants were selected through snowball sampling where key informants, who meet the criteria, were first selected. Then these participants referred to other participants that met the criteria and contributed with rich information for the study (Merriam, 2009).

Semi-structured interviews were conducted to eleven participants. They were asked predetermined questions about certain topics, but other questions or insights arrived during the guided conversation as the researcher provided a permissive and flexible atmosphere. This atmosphere encouraged the participants to talk freely about the given topic (Narayasamy, 2009).

Two focus group interviews were also conducted to a group of five participants. One group was made up of 3 participants, who were part of one association, and another focus group was made up 2 participants from a different association. Information gathered in focus groups, allowed participants to express their views in a social context (Merriam, 2009).

Confidentiality was keep by coding the information provided by participants. Respondents were coded by the type of method used to gather the information. Thus, participants that were part of an interview were coded with the letter “I”, e.g., 1-I, and participants who were part of a focus group were coded with the letters “FG”, e.g. 1-FG. Also, a random number was assigned to ensure confidentiality of the participants.

Validation of the information was done through triangulation, adequate engagement in data collection, peer reviews and member checks. Triangulation was conducted through the use of various data-gathering methods, such as interviews and observation. The researcher was able to observe and interview the participants in different times and different places and interviewed participants with perspectives to compare and cross check the data. Furthermore, collected data from participants was compared to literature sources to validate the information provided by participants (Merriam, 2009).

Prolonged engagement was reached during the research process as the researcher stayed in the researched area for a prolonged period of time, one month. In addition, the researcher was able to participate in professional, cultural, and social events that allowed her to have a holistic perspective of the phenomenon under study.

Data were also validate through a peer review, where a colleague who is part of the staff of the AGTEC project reviewed the data collected, demographics of the sample, and categories of the case study. The discussions and observations from this review were recorded in a peer debriefing memorandum. Finally, internal validation of the data was accomplished by member checks. Participants that were interviewed were asked to

review the recorded data and interpretations done by the researcher. Participants reviewed the notes and approved them or recommended changes that were done at the field level. All these methods were applied to validate the data gathered in this study.

Findings

Through the use of the farm research system methods, two themes emerged: the environmental factors, which are the ones that are not under the farmers' control, and the farm system characteristics, which are considered to be under the farmers' control. Later, through the use of participatory rural appraisal tools information previously gathered was analyzed to define the primary needs of farmers to achieve agricultural development.

Environmental Factors

The environmental factors are components in the system that cannot be controlled by the farmer. Categories, such as physical, biological, economical, and social factors, emerged from this theme. These categories were exposed by the farmers to explain how these external factors affect their decision process to adopt an innovation in their farms.

Physical Factors

Participants were asked about the temperature ranges, average rainfall, and types of soil existing in their farms and communities. Farmers recognized temperature and the amount of rain during the year as the main climatic factors that affect their crops and agricultural activities the most (4-I, 5-I, 7-I).

All participants recognized two main seasons during the year: the rainy season and the dry season. The rainy season is characterized by the presence of heavy rains and constant winds. The temperature, during this season, might drop to 6° Celsius, which causes frost that affect crops such as broccoli (10-I). This season normally lasts an average of five months, from May to October (4-I, 8-I) which agrees with official weather information that shows that highest records of rainfall in 2008 occurred during the months of May to October with rates that went from 101 mm/ per month to 280 mm/ per month (INSIVUMEH, 2009). On the other hand, the dry session lasts an average of seven months, from November to April. According to official data, these months in 2008 showed low levels of rainfall of 0.1 mm in December to 19.6 mm in April (INSIVUMEH, 2009).

According to the majority of the farmers, the temperature is stable through the year. Participants said the temperature varies according to the location and altitude of every community. The National Institute of Seismology, Vulcanology, Meteorology, and Hydrology of Guatemala (INSIVUMEH, 2009) confirms this observation through records from two different locations of Chimaltenango. The first location, San Martin Jilotepeque, with an elevation of 1800 meters above the sea level presents a range of temperature of 12.2-23.4° Celsius; while the second location, Santa Cruz Balanya, which has an elevation of 2080 meters above the sea level presents a lower temperature range of 9.5-22.6° Celsius.

Some participants mentioned an average temperature of 14° Celsius (1-FG), while others said the average was 18° Celsius (2-FG). Other farmers considered that the

temperature was the same throughout the year, but major variations occur during the day where temperature ranges from 14-28° Celsius (3-I, 9-I, 11-I). Regarding the temperature, other group of farmers mentioned that March and April are the hottest months of the year.

All participants recognized drastic changes in the climate during the last fifteen years. They stated that the length of the seasons has been altered. They have observed that the dry season lasts longer and there are less months of rain during the year. The extended dry seasons cause drought that affect the growth of the crops, as the majority of the participants depend entirely from the water provided by the rain (5-I, 12-I). These unpredictable changes have also caused other effects, such as the presence of strong winds that have destroyed the maize production in certain communities. Therefore farmers mentioned their concern about the climatic changes and the effects that they are having on their crops. They also expressed their frustration as they do not know how to prevent or deal with these unpredictable changes (10-I, 11-I, 12-I).

Official data from the main weather station in Balanya, Chimaltenango reveals an annual average temperature of 16.6° Celsius for 2008. During the last 18 years there has been a slight decrease of 2° Celsius in the annual average temperature, from 18.5° Celsius registered in 1990 to 17.1° Celsius registered in 2007. Monthly average temperatures throughout the last year did not vary significantly, being 14.1 ° Celsius the lowest temperature registered in January and 17.7° Celsius the highest registered in May (INSIVUMEH, 2009).

Farmers explained that they do not have access to accurate information or recorded data of the temperature and rainfall rates of their communities. The information they know is from their experience and observation through time (2-I, 8-I).

The National Institute of Seismology, Vulcanology, Meteorology, and Hydrology of Guatemala (INSIVUMEH, 2009) recognizes the presence of a variety of micro climates in the region of Chimaltenango. They also point out that this region is densely populated. The human factor in this region greatly contributes to the presence of climatic alterations (INSIVUMEH, 2009).

Farmers recognized the presence of a variety of soils in the area. A group of participants mentioned that they classify the soils according to the different colors they observe. They mentioned the presence of black soils as the healthiest soils (12-I). They also said that there are not a lot of black soils anymore because people have used for agricultural purposes (10-I). Others mentioned the difference in productivity between soils in steep areas compare to flat areas. In the case of corn, when produced in slope areas, it produces two hundred pounds of corn per 84 meters; meanwhile, the same area located in a flat zone will produce eight hundred pounds (11-I).

Information provided by participants agrees with the literature which mentions that soils in Chimaltenango have volcanic origin and are characterized by the presence of large quantities of organic matter. The amount of organic matter in areas in the wilderness reach 20%, while areas that have been cultivated show smaller percentages of organic matter due to biological processes and high levels of erosion. The majority of the soil is used to produce corn and pasture; farmers use rudimentary practices and are

inefficient. The type of soil is not suitable for corn production, but farmers still plant it, causing the degradation of the soil of the region (“Soils of Guatemala,” n.d.).

Biological Factors

Farmers where asked about factors that influence the health and vitality of their crops and animals, including insects, diseases, and weeds. Farmers mentioned insects and diseases were the major problems they face in crops such as tomato, coffee, and broccoli. These crops were grown as intensive monocultures in big quantities, which attracted more plagues and diseases. One participant mentioned that, to control plagues in intensive systems, they have to use strong chemicals (4-I). Two participants stated that, “nematodes and white flies are the bigger problems we face in tomato production” (9-I, 15-I). While other participants mentioned that, “the coffee berry borer is their biggest enemy when producing coffee” (2-FG).

Other participants, who grow mainly corn and beans, indicated the presence of insects like the june beetle, but they clarified that it does not cause significant damages to the plants (10-I, 12-I). The rest of the participants considered that they did not have biological problems affecting their crops and animals (2-I, 3-I, 8-I, 1-FG).

Another concern expressed by some participants was deficiencies in the growth of the plants. They recognized these problems being caused by deficiencies of certain nutrients in the soil. Some of the examples they mentioned were plants of corn and beans not growing tall enough, the fall of the flower in the case of fava beans, and the presence of black spots in the base of tomatoes. They also stated that these deficiencies were

easier to fix than controlling pest and diseases, as in these cases they just have to apply specific fertilizers to the soil (9-I, 11-I).

The presence of weeds in the crops is not a concern for participants (4-I, 5-I, 10-I, 11-I, 12-I, 2-FG). The majority stated that a manual control of the weeds is enough (10-I, 11-I, 12-I). The rest of the participants said they use herbicides to prevent their presence and effects of weeds in their crops (4-I, 5-I).

Economical Factors

This question focused in understanding the economical factors that influence the farmers' decisions towards their farm systems. There were two categories that emerged; access to credits and supplies by farmers and the marketing conditions of the farmers' products.

Credit and agricultural supplies for production. Agricultural supplies are required for the production cycle of all crops. The most common supplies bought by small farmers are chemical fertilizers and products to control pest and diseases in their crops. Thus, supplies are the biggest cost for small farmers and, sometimes, they cannot afford them (4-I, 5-I, 10-I, 11-I, 12-I).

The access to supplies depends on the farmers' economic conditions and the country's agricultural policies. Participants mentioned they previously bought chemical fertilizers at a lower price because the fertilizer was subsidized by the government, but they do not have access to the subsidized fertilizers anymore. Participants recognized the benefits when they were able to pay the subsidized price. However, they cannot afford the normal price of the fertilizer, so they do not use any fertilizer at all, which has

affected the growth of their crops. One participant reiterated, “we were dependent on the use of chemical fertilizers and now we need to learn about fertilizers that are effective and will cost us less” (10-I).

Small farmers have different sources of funding for their agricultural activities. Some are able to cover all of their costs, while others borrow money from friends, organizations, or banks. Participants stated that, “we don’t like to borrow money, but we are forced to look for credits to sustain our farm” (9-I). This is the case of farmers who got a credit as a group and used it to build a greenhouse and install an irrigation system to grow tomatoes under an intensive system. Thus, technology was required for the group to produce bigger quantities with specific quality standards (15-I).

The access for credits in Guatemala, as in other countries, is limited to farmers with collateral and history credit. A significant number of small farmers do not have collateral as they are landless; thus, they have no access to credit. Farmers with no access to credit are limited to growing small quantities of basic crops for family consumption (10-I, 11-I).

Participants that required credit, but do not have collateral, have looked for alternative organizations. These organizations provide group credits for agricultural uses. Farmers use their credit to buy animals, seeds, basic tools, fertilizers, and agrochemicals for plant and animal production (2-I, 3-I, 4-I, 5-I, 7-I, 8-I). Group credits have helped members improved their productive activities and increase their monthly incomes.

Access to markets & marketing conditions. Participants reported diverse situations concerning the access to markets for their products. They mentioned that the markets they approached depend on the type, quantity, and quality of the products that they have each season. The majority of farmers mentioned that they sell cash crops, such as broccoli, snow peas, and french beans, to intermediaries that come to their communities to buy them. They receive a lower price, but they prefer this as they do not have a vehicle to transport the products to the nearest central markets, such as the one in Chimaltenango or in the capital city of Guatemala. Participants who live in rural communities far from central markets also expressed their discontent with the bad conditions and lack of safety on certain main roads that must be used to get to these markets. They prefer to deal with the intermediaries' low prices instead of risking their lives for better prices in the central markets (4-I, 5-I, 8-I).

Other participants located close to big central markets expressed their confidence in their ability to find a variety of buyers for their products at a good price. They have identified buyers, such as restaurants or final consumers, who buy their product constantly. These participants stated that, "having a constant market for our product has allowed us to plan our productions and get fair prices that cover our production costs" (9-I, 15-I).

A minority of farmers indicated that traditional subsistence crops, such as corn, beans, and fava beans, are produced for family consumption only. Therefore, they do not look for buyers for these products; however, when they have excess of these products they have sold them to intermediaries (10-I, 11-I, 12-I).

Participants stated that prices of agricultural products in the markets are unstable. For example, the price of a particular crop can be up when a farmer decides to plant it and drops when he/she harvests it. Farmers are aware of these changes in prices through constant contact with others farmers and intermediaries. They stated that they believe they have enough information about the markets' performance, but their biggest constraint is the lack of information to access stable markets that will buy their products at a fair price throughout the year.

Social Factors

Participants were asked about the social factors that influence their acceptance of innovations. Two categories, land ownership and division of labor, emerged. Answers varied significantly among participants as conditions greatly vary from community to community.

Land ownership. Land is a vital resource for farmers. Small farmers have access to land through different methods, such as family heritage, purchase, or rent. Some of the participants who were interviewed stated that they own the land on which they work. They explained that, normally, the family land is divided into smaller pieces to be distributed to the new generations. Thus, the size of farms is reduced every time a new family division is done (2-I, 4-I, 5-I, 11-I, 12-I, 2-FG). Another similarity among participants who work on family land is that they also plant the same crops and use the same practices their parents and grandparents used in the past (11-I, 12-I, 2-FG).

Farmers that do not have access to land through family heritage have to do temporary contracts to rent different pieces of land. Temporary land does not stimulate

farmers to invest in infrastructure projects or to improve the resources within the farm (7-I, 8-I, 9-I, 10-I, 15-I).

Participants, who are members of an association, own or rent land as a group. One example is a group of farmers who bought a piece of land with funds provided by an international donor. On the other hand, members from another group rent a piece of land under a ten-year contract. These pieces of land are used to implement group projects, such as a nursery and a greenhouse, respectively (9-I, 15-I, 1-FG).

Division of labor. The roles and responsibilities of women and men in agriculture were dictated by the families' economic, social and cultural conditions. The participation of women in agricultural and leadership activities has slowly been accepted in rural and urban areas.

Participants from two rural communities stated that men are in charge of agricultural activities. As a tradition men are responsible for planting, fertilizing and harvesting the main crops such as corn and beans. Women and children also help with these activities and also take care of small animals such as chickens (8-I, 10-I, 11-I, 12-I).

Similarly in another rural community, participants mentioned that men and women have clearly defined roles. In these cases, men were responsible for the crops, such as tomato and snow peas, produced for the local and national markets. Women were responsible for growing the products for family consumption such as corn, beans, and small animals. In other words, men were responsible for maintaining the agricultural businesses, while women were in charge of the families' nutrition (5-I, 6-I).

Other communities showed more participation from women in agricultural activities. This was the case with organizations and associations, who have women as well as men as members where all have equal participation in agricultural activities. Therefore women and men share equal responsibilities in animal and agricultural production. In these cases, women and men are active in the production and commercialization of agricultural products (2-I, 9-I, 15-I, 1-FG, 2-FG).

Women's associations and groups encourage the participation and leadership of women in agricultural and economic activities. In these cases, women make independent decisions to improve the economic conditions of their families (8-I, 9-I, 15-I). These groups are being slowly accepted by authorities and communities.

Farming System

The farm system is formed by the characteristics of the farmer. These characteristics include knowledge, beliefs, behaviors, attitudes, and goals. These characteristics are considered internal characteristics as they are under the farmers' control. They are important to identity and understand because they affect the adoption of innovations by farmers.

Knowledge of Farmers

The most common source of knowledge for small farmers is their past generations. The majority of participants learned to be farmers from their parents or other family members. One participant stated, "I do all what my father taught me" (15-I). Traditionally small farmers have done subsistence farming and they still do. They grow corn, beans, and fava beans, largely with hand labor, through the use of basic tools, such

as mattock, a shovel, and sometimes, chemical fertilizers. These subsistence crops are grown for family consumption only (4-I, 5-I, 10-I, 11-I, 12-I).

Production of traditional products such as coffee is also learned through transfer of technology from older to younger generations. This is the case of participants who have learned about the production, processing, and commercialization of this export product through their parents. Normally farmers acquire coffee patches or plantations that were already started in the production cycle, so their role is to continue the maintenance activities (2-FG).

On the other hand, participants who have diversified their farms through the production of cash crops, such as tomato, snow peas, french beans, and broccoli have learned new agricultural practices, cycles, and markets from outsiders (4-I, 5-I, 8-I, 9-I, 15-I). Outsiders are defined as an individual or organization that are not native to the area and are promoting the use of agricultural innovations.

Other activities such as animal production (including dairy production, meat production and small animal production) are learned from other individuals in the community or from previous work experiences. A participant indicated he learned how to milk and produce cheese from a farm on which he and his family used to work in. During his work experience on this farm, he acquired a great amount of experience; therefore, he decided to produce cheeses as his personal business (3-I). Another participant, in a similar situation, learned about chicken and pig production from a family's friend. She observed and practiced the techniques on the friend's farm and later,

she decided to implement those techniques on her farm as a secondary source of income (2-I).

Finally, a participant stated, “activities, crops and practices are naturally learned from other members of the community or friends. We should lead by example, and once we show results, others will follow us” (5-I).

Beliefs, Attitudes and Behaviors Towards Adoption of Innovations

Beliefs, attitudes, and behavior vary significantly among participants of the different communities and their economical and cultural situations. Participants, in general, are cautious about new practices, ideas, or projects. They are ready to practice demonstrations and observe the results. Results are also discussed among other members and adoption of new practices, or technologies depend on personal and group approval.

The majority of participants, who live in rural areas, believe they have limited access to supplies, credits, and market information. They also believe they will always practice subsistence agriculture and that they cannot improve their income through agricultural activities (2-I, 8-I, 10-I, 11-I, 12-I). This group of participants does not want to invest significant amounts of money in agricultural activities because they have an aversion to risk. Thus, they mentioned that they wanted to observe the results from one of the proposed practices before they would decide to adopt it or not. In addition, the participants proposed to try one new practice at a time, so they can evaluate them separately. Participants tend to be cautious about their decisions; one of them mentioned, “if I see that the demonstration works, then I will apply it in farm and even teach it to others; but, first, I have to see it” (10-I).

An example of how beliefs affected adoption was told by one of the participants. She mentioned that they receive continuous training about the production and application of organic fertilizers. They learned and tried fertilizers, such as vermi-compost and bokashi, on their farms. Later, they stopped using these fertilizers because they "believed that it was time-consuming and that they didn't have the materials available in their farms to do the fertilizers" (8-I). At the present, they are not interested in applying organic agriculture because it does not satisfy their needs.

In contrast participants in urban areas believe agriculture can be an important source of income for their families. They are more confident about trying new practices and technologies. They have less of an aversion to risk than rural farmers, but are still cautious about adopting changes. These participants see agriculture as a business where they are the entrepreneurs (9-I, 15-I, 1-FG). One participant mentioned, "I see myself as an entrepreneur and I wish that all farmers will have the opportunities we have" (9-I).

Goals

All participants have improving their monthly income as their major goal. Each participant mentioned a different way to achieve this goal. Some believed that they needed to improve their agricultural practices for the products that they already know how to grow (4-I, 5-I, 10-I, 11-I, 12-I). Others want to expand the activities that they are doing (2-I, 3-I, 9-I, 15-I, 1-FG). Furthermore, other participants want to reach stable markets that will pay them fair prices for the products (7-I, 8-I, 2-FG). Farmers also recognized that the improvement of agricultural practices, expansion of productive activities, and location of new markets required funds that they do not have.

The goal of a group of participants, who received credits to invest in their farms, was to increase the association's funds for the members to get bigger credits. They mentioned that they already have their small agricultural businesses going and they want to expand them (2-I, 3-I). They also felt that they will achieve better results by getting technical assistance to efficiently apply the credits (5-I, 7-I).

Other groups of small farmers, who have technical problems on their farms, want to learn appropriate agricultural practices to have a better production (10-I, 11-I, 12-I). Meanwhile other participants wanted to diversify their production by learning the production cycle of a new product that has good value in the market (1-FG, 2-FG).

Participants that already have stable productions are looking for new markets for their products. Their goal is to identify possible consumers and establish relationships to sell their product at a fair price that will at least cover their production costs (4-I, 5-I).

Types of Farm Systems

Farmers distinguished two different types of farming systems within small and medium farmers of the regions, a subsistence system and an intensive system. A subsistence system is a small piece of land that consists of multiple subsistence crops such as corn, beans, and fava beans and small animals such as, chicken or pigs as shown in Figure 1. Farmers in this type of farm system apply simple agricultural techniques, they have limited access to credit and external inputs such as chemical fertilizers. Subsistence crops are used for family consumption. The subsistence system is normally managed by men and greatly support by women. In cases where women are single mothers, women manage the subsistence farms.

Figure 1. *Photograph of an indigenous woman standing in front of her subsistence farm system where she grows corn.*

Intensive system is a single crop production as shown in Figure 2. Farmers specialized in the production of cash crops to be sold in local, national or international markets. The intensification of the systems requires the use of external agricultural inputs such as chemical fertilizers, products to control plagues and diseases, and irrigation systems. The investment is usually covered with credits from banks or organizations. It is likely common to see men in charge of intensive systems.

Figure 2. *Photograph of an intensive tomato production (cash crop) under plastic greenhouse and specialized drip irrigation system.*

Analysis of Priorities

Participants of this study were asked to evaluate different factors of production of several commodities. Information was organized and analyzed through the use of a matrix to "identify priorities that will give optimum returns on scarce investment" (Shinn & Briers, 2009, p. 16). The use of this qualitative tool has the purpose of analyzing the frequency of answers given by participants in this study. This matrix can be used with different types of participants, and as a planning and evaluation tool through the implementation of the project. Most important, it stimulates the discussion and further analysis of all parties involved in a project to define priorities among different components.

This matrix consists of four commodities are listed and eight components that are critical to the production and commercialization cycles of the commodities. Factors that were evaluated across all commodities were soil, water, fertilizer, pest management, infrastructure, transportation, equipment, and credit. All participants (16) decided about the importance of each factor by choosing between three categories: most important, important, and less important. The researcher assigned a numeric value to each category, where "most important" received a maximum of 10 points, "important" received 6 points, and "less important", received 3 points. Points were added and the totals were shown in Table 1 to indicate relative importance and priority from the participants' point of view. The sum gives an overall score to designate areas of highest importance.

Results revealed that certain factors such as water, transportation and credits were highly important for the production and commercialization of all commodities.

Meanwhile other factors such as equipment and infrastructure were considered least important by farmers to the cycles of these products. The definition of certain factors as priorities will allow the change agents to identify appropriate technologies to solve the issues with optimum returns for the farmers.

Table 1.

Definition of Priority Factors for Production of Four Commodities

	Commodities				
Inputs	Tomato	Snow peas	Corn	Poultry	Sum
Soil	160	160	160	57	537
Water	160	160	160	152	632
Fertilizer	144	140	140	60	484
Pest & Disease Management	152	140	89	99	480
Equipment	99	103	57	51	310
Transportation	144	140	148	156	588
Infrastructure	152	57	54	103	366
Credits	160	160	140	148	608

160= Most important 96= Important 48= Less important

Conclusions, Recommendations and Implications

Small farmers are aware of the physical, biological, economical, and social factors that affect their agricultural systems. First, in the case of physical factors farmers identified main components, as rain and temperature. They were aware of their yearly behavior which defined the planting and harvesting of products of the region. Farmers did not have accurate information about the weather conditions which can help them prevent effects caused by natural phenomenon such as droughts, frosts, or flooding.

As change agents, it is important to provide access to farmers with accurate and simple information about physical factors. It is recommended to make contact with the two regional weather stations in San Martin Jilotepeque and Balanya in Chimaltenango. This with the purpose of establishing a mechanism where monthly information (range of temperature and rainfall rates) is diffused in the local radio stations of the region. This information can help small farmers to plan their production cycles according to accurate information and avoid losses because of unexpected natural disasters. Also change agents should work with the agents of the regional office of the Ministry of Agriculture to develop prevention plans for farmers that live in areas that suffer droughts, flooding, or frosts on a yearly basis.

In terms of biological factors, small farmers were able to identify certain insects and diseases that affect their crops. They know certain insects and diseases by their common names and were able to identify the effects that they cause to the plants. Sometimes they cannot identify the problem and they ask other farmers who have more experience. The majority of small farmers control insects and diseases with the use of agro-chemicals. It is also common to observe the indiscriminate use of chemicals as farmers do not have enough information about the effects of these products in the environment and human health.

As a result, in the short term it is recommended that change agents provide training to farmers about the rational use of agro-chemicals to control plagues and diseases to prevent health and environmental problems. In the long run, it is recommended that farmers are trained on integrated pest management techniques for

them to correctly identify the plagues and diseases, quantify the effects on the crops and define appropriate ways of controlling them. This process is recommended as a transition for farmers to go from an indiscriminate use of agrochemicals to a rationale use of them, and hopefully to the use of organic practices in the future. Organic practices to control pests and diseases should not be introduced as the first and only options because farmers and their systems are not ready for this change.

The economical situations of small farmers are diverse and complex. In the majority of the cases, they have limited access to credit for investments in their farms. Thus, the technologies they use are basic and they have low production levels ("Soils of Guatemala," n.d.). One option available to counter the lack of credits to small farmers has been associations and organizations who offer groups credits to farmers with no collaterals. This has helped the farmers to invest in their farms and increase their productivity. Therefore it is important to support these associations to increase their funds for them to provide more access to credits to small farmers with no collaterals.

The use of organic fertilizers is appropriate for farmers that want to fertilize and do not have the economic means to do it. Organic fertilizers that are done with local available resources have a low cost and are effective (Hazeltine & Bull, 2003). As a result, it is recommended that change agents develop different types of organic fertilizers that make use of the resources available in each community. These fertilizers when done correctly (recommended proportions and appropriate decomposing conditions) can be as affective as chemical fertilizers for the growth of different crops at different stages.

The social customs of the people are clearly marked by the history and the culture of Guatemala. Women and men have clearly defined roles in agriculture and the family. Normally, women are responsible for producing subsistence products for family consumption, while men produce cash products. The role of women is starting to have more notoriety through their participation in groups that have allowed them to have active roles in agricultural, economical and community projects.

The assessment of the farm system allowed the understanding of the knowledge, beliefs, and goals of farmers (Shaner, Philipp, & Schmehl, 1982). Small farmers learned their knowledge and skills through a transfer of technology which normally occurs inside the family. Farmers have complete knowledge of their systems. This knowledge needs to be gathered and shared among the rest of the farmers to search for appropriate technologies that can satisfy their needs (Hazeltine & Bull, 2003).

Small farmers working in subsistence systems have limited economical resources what cause them to be risk averse to innovations. In order to diffuse innovation among these types of farmers it is recommended to conduct practices that use local available resources (Hazeltine & Bull, 2003) and have short term results. Change agents should reduce the complexity and increase the observability of innovations for small farmers to adopt innovations over time (Rogers, 2003). Observability can be increased through the implementation of demonstration plots in community property.

Farmers managing intensive system are less risk averse and perceive agriculture as a business. Thus they are open to invest in long term innovations that would increase

their productivity. They are also open to try innovations in their own farms which allow trialability of innovations by single farmers (Rogers, 2003).

Farmers' common goal is to improve their monthly income to provide better conditions for their families. They clearly know their goal, but they are also aware of all their problems and constraints. Therefore it is important for change agents to systematically gather information about the beneficiaries and facilitate the use of participatory tools such as matrices to analyze areas of work based on farmer's priorities. This information will support the definition of priorities based on the available natural and economical resources that will give optimum results for the beneficiaries and the project.

A CASE STUDY TO SELECT OPINION LEADERS TO DIFFUSE AGRICULTURAL INNOVATIONS IN CHIMALTENANGO, GUATEMALA

Introduction

Heemskerk (2005) observed that agricultural innovations are changing to be more demand driven to respond to farmers' needs. Farmers need to be active participants of the development and diffusion of innovations to make adoption happen.

The role of the change agent in the diffusion process is to promote a participatory environment where opinion leaders will lead the diffusion and adoption of innovations. Rogers (2003) emphasized that "the opinion leaders approach magnifies the change agent's effort" (p. 388). Therefore it is important for change agents to recognize the social network and empower opinion leaders to share the responsibility of diffusing innovations to other farmers.

The involvement of opinion leaders increases the credibility of innovations because these opinion leaders can convince their peers to adopt the innovation. In addition, innovations that are validated by an opinion leader acquire local sponsorship and sanction (Rogers, 2003). Therefore, to achieve long-term adoption, opinion leaders should lead the diffusion process.

Change agents, as sole entities of the diffusion of innovations, have scarce resources and limited access to peers. Rogers (2003) suggests that communication strategies should target opinion leaders, who then are going to target their peers. The number of individuals reached at the end is higher and adoption is sustained through time.

Participatory approaches have shown to be effective when innovations are diffused. Change agents have realized the importance of identifying opinion leaders and keys players to collectively implement innovations among social networks.

Literature Review

According to Heemskerk (2005) a natural characteristic of farmers is that they "innovate to sustain, expand and improve their production systems" (p. 1). Therefore it is important to promote the diffusion of agricultural innovations among all farmers through social networks.

Rogers (2003) defined diffusion as, "the process in which an innovation is communicated through certain channels over time among members of the social system" (p. 5). This definition identifies three key components: innovation, communication channels, and social system. First, Rogers (2003) defines an innovation as "an idea, practice, or object that is perceived as new by an individual or group of individuals" (p. 12). More specifically an agricultural innovation is defined as, "the product of social negotiation among stakeholders" (Heemskerk, 2005, p. 1). Rogers also defines a communication channel as, "the means by which messages get from one individual to another" (p. 18). The most influential channels in the diffusion process are interpersonal channels which "involve face-face exchange between two or more individuals" (Rogers, 2003, p.18). Finally, the social system is defined by Rogers (2003), "as a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal" (p. 23).

Rogers (2003) observed that a common source of information in all stages of the adoption process of an innovation is interpersonal communication between farmers, friends, and neighbors. Starting with the awareness stage, farmers (possible adopters) learn about an innovation's existence and characteristics from peers through a social learning process which lowers uncertainties related to adoption. Later, during the interest stage, farmers become interested and gather details about the innovation from other farmers. Then, in the evaluation stage, farmers discuss the positive and negative aspects of adopting the innovation with other farmers and develop a joint evaluation. Afterward, in the trial stage, farmers do small-scale trials to observe the innovation. Finally, during the adoption stage, farmers use the innovation in a large-scale operation as an ongoing practice.

Social Networks

A social network analysis recognizes all interactions between individuals of a social system. It also identifies the influence that certain individuals have over others' choices and decisions (Monge, Hartwich, & Halguin, 2008). The type of links and relationships between human actors of the system show their social structure (Knoke & Kuklinski, 1982). According to Kohler, Behrman and Watkins (2007) and Hogset (2005) (as cited in Monge, Hartwich, & Halgin, 2008), "social networks affect the diffusion of innovations through social learning, joint evaluation, social influence, and collective action processes" (p. 9). Therefore it is important to study the nature of the different networks, identify the social links, and define participatory strategies to diffuse an innovation among the network.

Horizontal and Vertical Communication

Feder and Slade (1985) found that the diffusion of information in a social system depends on interpersonal communications among individuals. These horizontal communications occur between farmers with similar social and economical characteristics, who are able to persuade each other to adopt innovations and knowledge. Individuals from other communities, who are identified as outsiders of the social structure, are not considered as key players or opinion leaders, especially in isolated areas.

Horizontal communications promote the observation, monitoring, and discussion of farmers' experiences. These dialogues allow them to evaluate innovations and make decisions about adoption between their peers. However, peers generally have access to the same information. To learn about innovation they must have vertical communications (Monge, Hartwich, & Halguin, 2008). A common source of new information and innovations in a social structure are opinion leaders.

Opinion leaders, who are also local farmers, are sufficiently heterophilous to be good sources of advice (Fliegel & Korsching, 2001; Rogers, 2003). According to Rogers (2003), they are able "to influence other individuals' attitudes or change behavior informally in a desired way with relative frequency" (p. 388). In addition Becker (1970) (as cited in Monge, Hartwich, & Halguin, 2008) opinion leaders are described as, "early adopters of culturally acceptable innovations and generally are opponents of culturally unacceptable ones" (p. 12). They are important determinants of rapid and sustained

change. Opinion leaders are considered the bridge between farmers and sources of innovations.

Opinion leaders are used as role models in the adoption on innovations. This can be effective at the social and economical level of the diffusion process. From the economical perspective of projects' implementation when diffusing an innovation, opinion leaders multiply the efforts of the change agent by carrying the message to more possible adopters. This translates into effectiveness by achieving more diffusion in less time. At the social level, once opinion leaders have adopted an innovation, that innovation acquires local sponsorship and credibility (Rogers, 2003).

Opinion leaders have certain characteristics that make them heterophilous, thus different from their followers and able to contribute to their social systems with innovations. Rogers (2003) observed from different studies that opinion leaders tend to have access to mass media information and external contacts that provide them new ideas from outside. Additionally, opinion leaders have "greater contact with change agents, social participation, higher social status, and more innovativeness" (Rogers, 2003, p. 362).

Interventions designed to use interpersonal communications, social interactions, and social contacts to promote change or an innovation are called peer networks (Valente & Davis, 1999). The reinforcement of peer networks is important to sustain adoption of agricultural innovations over time.

Selection Process of Opinion Leaders

Valente and Davis (1999) identified a set of procedures that allows researchers to analyze a social network to locate opinion leaders and their interactions among the network. Some of the suggested recruitment procedures were: a) individuals select themselves to be leaders; b) external individuals or key informants select leaders; c) community members select participants that select other participants (snowball); d) selected community members select opinion leaders; and e) all community members nominate opinion leaders. The two first procedures showed not to be effective because of possible bias selection. Therefore the most recommended methods of selecting opinion leaders are participative procedures like c, d, and e that allow all individuals to be part of the selection process. Frequently, opinion leaders are selected based on two important characteristics, credibility and trustworthiness, and other factors, such as gender, ethnicity, and geography.

Innovations in Latin America

Common problems found in the traditional top-down extension services of countries such as Bolivia, are obstacles in the communication and management of knowledge (information and skills) and the inability of the system to reach all farmers (Hartwich, Monge, Ampuero, & Soto, 2007). The limitation to reach all farmers is due to the use of a vertical system where extension agents are responsible for all interpersonal communications that occur. Therefore, there is a need to replicate the diffusion of innovations through the analysis of social networks of small farmers to

identify opinion leaders who will support the diffusion process to reach bigger numbers of farmers.

Evidence provided by a study conducted in three areas of Bolivia, suggests that farmers from rural areas adopt innovations based on persuasion, social influence, and competition within their social system (Monge, Hartwich, & Halguin, 2008). This study confirms that using the farmers' influence over their peer networks is effective to diffuse the adoption of agricultural innovations.

Different research studies address the importance of analyzing the social structures to diffuse innovations. Efforts are focused on identifying early adopters or opinion leaders as a strategy to maximize resources and center efforts. The goal of these efforts is that others will adopt the innovation by imitation. However, this is not always accomplished; because some farmers will not adopt because of the presence of cultural, economical, and social factors. According to Rogers (2003), usually, "the consequences of the diffusion of innovations widen the socioeconomic gap between the earlier and later adopting categories in the system" (p. 460). Therefore, it is important to identify leaders from different socioeconomic classes who will support the diffusion of innovations in the different classes to decrease the inequality among beneficiaries.

It is also important to mention that several studies about the application of social networks analysis have been done in areas such as economics and marketing, but few about the innovation in agriculture (Monge, Hartwich, & Halguin, 2008). Therefore this research study will define a methodology to identify opinion leaders that will contribute

to the diffusion of agricultural innovations among small farmers in the area of Chimaltenango, Guatemala.

Background on the Study Context

The region of Chimaltenango has a recognized political structure which is made up of individuals that have been elected by the populations. The authorities are respected leaders that guide the economic and social growth of the urban and rural areas of the region. The main authority of the region is the governor (called CODEDE-Departmental Counsel for Development), who is in charge of facilitating the social and economical development for the region. He coordinates development projects with the mayors (called COMUDE-Municipal Counsel for Development) of the different municipalities who then coordinate activities with the rural villages through the main authorities of each village, the COCODE (Community Counsel for Development). The system of communication between the central area and the villages is considered a vertical system. Under this system, small farmers are informed of agricultural training opportunities or projects by the local authorities or COCODES. Farmers attend sessions and get involve in activities that they consider can bring a social or economic benefit to them and their families. Farmers also have different levels of organization; some are part of organized groups, such as associations or cooperatives, and others are independent.

This case study analyzed the social network of these farmers to identify their links and relationships. Farmers were asked about their perceptions about the opinion leaders and how they can lead the diffusion process of innovations among them.

Purpose and Research Objectives

The purpose of this study was to analyze the social networks of farmers of Chimaltenango, Guatemala. The specific objectives were as follow:

(a) Describe the social network and identify the opinion leaders, participants, their links, and relationships;

(b) Identify the roles of opinion leaders in the diffusion of agricultural innovations; and,

(c) Describe the applicability and diffusion of techniques learned through training.

Methods

Qualitative research was used in this study to "understand how people make sense of their experiences" (Merriam, 2009, p. 37). Qualitative methods were used to gather individuals' opinions about who they think are the opinion leaders, what are the characteristics of the opinion leaders, and what are their perceptions of how these leaders influence the adoption or non-adoption of agricultural innovations.

The study focused on small farmers and opinion leaders of a particular area Chimaltenango, Guatemala, and more specifically, individuals participating in the training activities provided by the AGTEC (Agriculture in Guatemala: Technology, Education, Commercialization) project. This intrinsic case study provided a thick description of the social networks and their interactions over a specific period of time (Merriam, 2009).

The researcher used a purposive sample consisting of 15 individuals. Individuals in the sample were identified through snowball, chain or network sampling. This type of sampling allowed the researcher to identify a few key informants who meet the criteria defined by the study. These individuals were asked to refer the researcher to others whom they know can provide rich information to understand the phenomenon (Merriam, 2009).

According to Merriam (2009), “in qualitative research, interviewing is often the major source of the qualitative data needed for understanding the phenomenon under study” (p. 114). In this case, data were collected through semi-structured interviews to individuals and focus groups. These interviews were guided by a set of questions, with no predetermined order, to gather information about the participants’ experiences, opinions, knowledge, and perceptions about opinion leaders (Merriam, 2009). Ten individuals were interviewed in a one to one basis, and five individuals were part of two focus groups. One focus group was made up of three individuals from one association and the other was made up of two individuals from another organized group.

Observation and journal entries were used to gather information about participants. Observation provided knowledge of the context of participants and systematically gathered behaviors and reactions to training sessions. Journal entries allowed the researcher to collect the information gathered about events, such as visits to farms and training sessions.

Respondents were coded according to the type of method used to gather the information, I-Interview and FG- focus group. In addition, a random number was assigned to ensure confidentiality of the participants.

Validity and reliability of this study were kept through different methods, including triangulation, member check, adequate engagement in data collection, and peer reviews. Triangulation was done by interviews, observation and reviewing documents about the categories. In addition, all the information and tentative interpretations gathered during interviews were reviewed and checked by participants. Raw data, interpretations, and categories were discussed with colleagues from the AGTEC project to confirm the validity. Finally, the researcher stayed at the research site for a month to adequately engage with participants and the project.

Findings

Three categories emerged during the study, including, social networks, characteristics of leaders, and applicability of training topics in the region of Chimaltenango, Guatemala. Representative quotes are included to reflect the participants' voices.

Social Networks

Participants for this study were asked to identify their positions inside their social network. A groups of participants identified themselves as political leaders, including COCODES (8-I, 10-I, 11-I), mayor's assistants (12-I), and municipality's workers (1-I), others identified themselves as organizational leaders (6-I, 9-I, 13-I) and, finally, others

identified themselves as members of a group/organization or rural communities (2-I, 15-I, 1-FG, 2-FG).

Roles of a Leader

The role, links, and relationships of participants varied according to their positions. The political leaders interviewed were elected by the members of their communities. In the case of the mayor's assistant, his major role was to be the link between the mayor and the community members to satisfy the people's needs and implement development projects (12-I). The COCODES are counsels that work with the people to try to alleviate their social, economical, and environmental problems through the implementation of local projects (11-I). On the other hand, municipality's workers are elected by the majority and their role is to implement projects that respond to the mayor's work plan (1-I). Political leaders are part of a vertical system with structured communication channels and recipients. In this case, the mayor and his/her staff are the center of the system. The mayor communicates and coordinates activities with the rural communities through the mayor's assistants. They implement activities and projects at the local level with the COCODES who organize the community members.

Organizational leaders are individuals that are recognized as opinion leaders by the peers from their organization. They organize their members into specific projects or activities that respond to the organization's goals and objectives. Leaders in this category clearly defined their role and responsibilities among the organization. One respondent stated, "as a president, I make contacts with other organizations (NGOs, local and

national authorities) to look for funds to support the design and implementation of economical projects for the members of the association" (9-I).

Other participants defined themselves as members of an association or community. As followers, they were aware of the social structure of their group or community and recognized their leaders and responsibilities (15-I, 1-FG, 2-FG).

Participants, who identified themselves as opinion leaders, identified common roles, such as maintaining constant communication with peers about new projects and activities through meetings and informal conversations. Other roles that were recognized by leaders were the need to organize people into projects for their well-being and to negotiate projects and funds with external entities (9-I, 10-I, 12-I).

Participants recognized formal, as well as informal, leaders. Informal leaders where recognized based on their success as farmers and their extensive professional and social networks (11-I). Others were considered leaders because of their age. Older people in rural communities are respected by their peers because they are considered to have more experience and knowledge compared to younger members (10-I).

Role of a Leader in the Diffusion of Agricultural Innovations

Agriculture is the main economic activity of small farmers in the region of Chimaltenango (2-I, 8-I, 9-I, 10-I, 11-I, 12-I, 13-I, 15-I, 1-FG, 2-FG). Participants have applied traditional agricultural practices to produce mainly corn and beans for family consumption. As farmers they are looking for low-cost, effective practices that produce higher productivity with less cost (10-I, 11-I, 12-I). As leaders, they are trying organic techniques in small areas, and if they get positive results, they want to share the

knowledge and skills with other farmers so they can improve their income and quality of life.

Other participants with formal leadership positions are constantly looking for workshops that can teach them improved agricultural techniques. They are also searching for funds, credits and projects for reforestation and agricultural activities to benefit the small farmers of their areas with improved practices such as greenhouse production and irrigation systems (1-I, 9-I, 2-FG).

Links and Relationships among the Social Network

As part of the process to get to know the social network, participants, where asked about a person whom they may contact in case they have a question about agriculture. The majority responded that they would go to the person with the most agricultural experience in the community. According to the respondents, an experienced farmer is someone who has had high yields in past productions and has several market contacts to sell the agricultural products at a good price (10-I).

Participants mentioned that, when they asked for technical assistance from peers, they also look for someone they trust and with whom they are familiar. In most of the cases, these people were family members or close friends (8-I, 9-I, 15-I). In other cases, respondents mentioned they may contact the formal leaders from their associations or communities (6-I, 10-I, 12-I, 2-FG).

To learn about the level of organization, participants were asked if they were part of an organized group such as associations or cooperatives. Ten of the fifteen respondents were part of different farmers' groups. Groups are formed with different

purposes, such as getting micro-credits to apply to agricultural activities (2-I, 6-I), or implement improved agricultural production techniques such as greenhouses (8-I, 9-I, 1-FG). Other farmers get together to sell agricultural products, such as coffee, in bigger quantities (2-FG) or to implement food processing projects.

In order to analyze the social network, participants were asked about their level of exposure to agricultural innovations and interactions with extension agents. Most of them who were farmers indicated that they did not have direct contact with extension agents. Leaders working in public or non-governmental organizations mentioned a higher level of interaction with extension agents and a higher exposure to observe agricultural innovations. They also wished that these contacts would be available on a daily basis for farmers who are the ones that need the technical assistance the most (13-I). In terms of the level of innovation that the participants were exposed to in their daily life, members from one rural community showed a higher exposure to improved horticulture production. They all mentioned one individual responsible for the agricultural and marketing innovations happening in that specific community (10-I, 11-I, 12-I). Two participants from the same association mentioned how they have been exposed to new products through other members of the group (2-I, 6-I). On the other hand, other participants presented their concern of not having access to observe and practice agricultural innovations (8-I, 11-I, 15-I, 1-FG, 2-FG).

Characteristics of a Leader and Techniques to Influence Others

A leader should have desired characteristics in order for individuals to follow. In this case, participants were asked about the characteristics they think a leader should

have or characteristics that have worked for them as leaders. A leader should work with others, as a team, to accomplish common goals (1-I, 12-I, 2-FG). A leader reinforced this concept by saying, “I don’t work alone, I am sure that I would not have accomplished anything by myself” (1-I). Some individuals contribute with, “contacts that are the ones that help me look for funds to implement new development projects. And, I also work through the authorities of the rural communities, who know their people, and they help us diffuse the information” (1-I).

Another two participants mentioned honesty as the most important characteristic a leader should have. They believed that when a leader is honest, people immediately trust him/her (2-I, 15-I). Others mentioned that a leader should be loyal to his/her followers no matter what. They also considered that a leader should be dynamic and active in order to benefit the group or community (6-I, 9-I).

Other respondents thought that a leader needs to have good communication skills and communicate with all the members, without discriminating (1-FG, 2-FG). Finally, other participants thought that a leader should share the information and knowledge they gain with others (2-I, 8-I, 10-I, 11-I, 12-I) in order for people to follow him/her.

Successful Development Projects Done in the Past

It is important to always learn from past experiences that individuals, groups, and communities have had. Therefore, leaders and followers shared success practices and projects that have worked for them in the long run. Recommendations were focused into types of methodologies, monitoring and evaluation techniques, and importance of sharing the cost of development projects.

A participant mentioned the importance of providing small incentives with short-term results for the people to observe results and motivate them in a long-term project (1-I). Another leader, who coordinates a microcredit group believed that providing constant follow-up to members and maintaining constant communication with them prevents consequences in the long run (2-I). Another leader mentioned the importance of sharing and celebrating the accomplishments of a group to encourage people to continue (6-I). A leader from an organized group thought that beneficiaries should share the cost of a project with the donor in order for them to appreciate and maintain the resources properly.

Other participants reinforced the importance of doing practical training. They thought that it was important for the beneficiaries of a project to learn by doing and be able to accomplish their own results. She said, “nobody learns from others’ experiences, therefore; the importance, of accomplishing our own experiments and projects like we do in our demonstration farm” (9-I). Finally, a respondent said, “for a project to last over time and be sustainable it should start small, where we can observe and monitor results, and later reproduce the knowledge or skill to others” (10-I, 11-I).

Applicability and Diffusion of Innovations

The sustainability of the training sessions and workshops offered to beneficiaries of the AGTEC project were measured through different questions during interviews and observations done at the field level. Participants were asked about how appropriate they thought the topics were for their conditions, if they would be able to reproduce them on their farms, and if they would be able to teach them to other farmers.

Participants thought the knowledge and skills that they learned through training were appropriate for their conditions. Organic techniques used to make and apply fertilizers were the most appreciated by farmers as they mentioned that they are an effective and low-cost option to produce their crops. This was especially true since the chemicals fertilizers they used to buy increased in prices over the last year. Farmers mentioned it was easier for them to reproduce the practice on their farm if they practiced the techniques during the practical training sessions. Participants also thought it was going to be easier to teach what they have learned to other farmers because they practiced the procedures of applying the fertilizers. They reinforced the importance of making all the training sessions practical and on their sites (10-I, 11-I, 12-I).

All participants mentioned the importance of teaching others what they have learned, but they clarified that not all farmers were opened to learning. Therefore, they talked about the importance of identifying those farmers who are interested in learning about the organic production. Some participants thought that they would teach first techniques to the members of their own families and, later, teach others outside the family network (10-I, 11-I, 12-I).

Participants, in general, thought that they could sustain the activities and projects they were carrying at the present. To improve in the future, they mentioned that education is crucial for agricultural development of the region. They mentioned that training should go hand in hand with components, such as access to credit or funds for investment (2-I) and information about national and international markets (6-I).

According to the participants, the sustainability of projects will be reached when "projects respond to local needs" (13-I). One participant also said that, for the project to be sustained through time, "techniques and practices should be taught and monitored from the beginning to the end; in other words, how to do them and how to maintain them" (15-I).

Recommendations

Strategy to Identify Opinion Leaders

The following is a recommended strategy to identify opinion leaders among groups of farmers. The steps are not listed in order; they can be done according to the environment, conditions, and negotiations with the different groups of farmers.

- Have a meeting where the leaders of the organized group and the leaders of the AGTEC project present their goals, objectives, and activities.
- The group should identify needs through participatory tools and analyze areas of priorities.
- Visit farms of different beneficiaries to observe local conditions and conduct interviews and focus groups with the farmers.
- The group will share the identified needs and priorities with the members of the members of the AGTEC project to identify opportunities to work together.
- Ask the members of the group to develop the criteria to select leaders. At the same time observe potential opinion leaders who have the desired characteristics described by participants.
- Facilitate the process for the group to select leaders among the members.

- Select the leaders and communicate to them about the role they will play in the diffusion of innovations. Look for their approval and start the training process and transfer of innovations.

Conclusions and Implications

Social networks in the region of Chimaltenango are diverse. The most-known, structured and recognized networks in the rural and urban areas of the region are made up of the political networks. These networks are effective to identify the different areas and their leaders and to get a formal approval to start the implementation of agricultural projects. Implementation should involve formal and non-formal leaders in order to reach all opinion leaders. In this stage it is important to communicate the diffusion strategy through the leaders and to empower them to continue with the diffusion process in the future.

Other types of networks are the ones created around organized groups, such as associations, cooperatives, and federations. They are recognized groups that have an organization of members, centralized diffusion systems, and specific goals and objectives. The advantage of working through these networks is that they have established vertical methods of communications. Therefore, it can be efficient to use their network to diffuse agricultural innovations. The disadvantage of using this strategy as the only means of reaching leaders is that information will not reach non-formal leaders outside of these networks who might also need technical assistance and innovations.

Independent farmers, who do not belong to any organized group, can be identified through meetings called by the local authorities of the rural areas. These non-formal leaders can provide support to establish a decentralized and horizontal diffusion system among their networks. A non-formal opinion leader is as effective as formal leaders, therefore; it is important, to include them in the identification of leaders.

Participants defined an opinion leader as a team player, who needs to be honest, loyal and dynamic. They concur with Rogers (2003) in terms that the opinion leaders should have good communication skills to be able to transfer information inside and outside the social network. Participants also mentioned that one of the main roles of opinion leaders is to keep access to media and information from outside networks and maintain social contacts that will bring innovations to their network (Rogers, 2003).

Opinion leaders are the source of information for community members. According to Rogers (2003), they are considered early adopters because they try agricultural innovations first. Later, if they have good results, they will adopt and validate the innovation. Afterwards, leaders will consider themselves as aides, who are less than fully professional change agents and who intentionally contact others to influence their innovation-decisions. This can be done by reproducing the techniques or innovations with other farmers at different sites to increase the observability of an innovation (Rogers, 2003).

Based on interviews and observations, the researcher defined a recommended strategy to identify leaders. This strategy has the purpose of providing a guide for the technicians of the AGTEC project to identify opinion leaders based on a criterion, not

randomly. The strategy proposes the selection of opinion leaders by their peers under a participative procedure where they will select them based on credibility, trustworthiness, and others such as gender and ethnicity.

The selection of opinion leaders, whose training allows them to become aides of the diffusion of innovations along with the change agents support the process of adoption over the time. In addition, according to Rogers (2003), opinion leaders validating the innovations in the different sites will also provide higher rates of adoption among the small farmers of Chimaltenango. The application of these strategies will assure the sustainability of the AGTEC project in the area of Chimaltenango, Guatemala.

SUMMARY AND CONCLUSIONS

Summary

Two issues emerged from this study. The first issue was the identification of conditions and needs of farmers through the use of participatory methods. The second issue was the identification and description of social networks and opinion leaders with the goal of diffusing the development process through opinion leaders for sustained adoption over time.

Participatory Needs Assessment

The needs assessment showed to be an effective method to systematically gather the conditions and needs (Etling & Smith, 1994) of small farmers. Data collected revealed that small farmers' situations were diverse and complex. The majority of participants were aware of the environmental conditions of their farm systems (Shaner, Philipp, & Schmehl, 1982). Some participants named and described different physical and biological characteristics in an empirical manner. In addition, small farmers explained the economic and social factors that affected their decisions towards the adoption of technology for their farms. What is most important is that farmers recognized their major problems and stated their goals. This scenario allowed the researcher to analyze and organized the data into a matrix to identify priority areas of work for the farmers and the AGTEC project.

Social Networks

The environmental context is as important as the social context when implementing agricultural development projects, such as the AGTEC project. Thus

findings from this study showed that the majority of members from urban and rural areas of Chimaltenango were part of different social and political networks. These networks reveal a clear structure, as observed by Rogers (2003), with defined opinion leaders, established links among other members, and communication channels.

Formal and non-formal opinion leaders were aware of their roles and recognize their characteristics as a leader. Also all leaders were open-minded and willing to contribute and be a part of the diffusion process to support the process of change. These leaders are recognized by Rogers (2003) as the aides who were are non-professional change agents and who influenced others to adopt innovation among peers. Leaders and aides also restated the importance of diffusing technologies that can be demonstrated to others to increase the observability and trialability as defined by Rogers.

Data collected in the two case studies provided a better understanding of the participants and their context. Environmental and social data allowed the researcher to develop strategies that could be used by the technicians of the project to better serve the communities of Chimaltenango.

Conclusions

The findings from this study offered the following conclusions:

A participatory needs assessment was an appropriate tool to systematically gather the needs and situations of the stakeholders and their context (Etling & Smith, 1994). Tools such as unstructured interviews, focus groups and dialogues were useful to gather data at both the group and individual level (Narayanasamy, 2009).

A deep knowledge about the environmental and social conditions of beneficiaries is required to facilitate the process of development. Information about the context is required to identify priorities and appropriate technologies. Appropriate technologies will vary according to the local, cultural, and economic conditions of every community (Hazeltine & Bull, 2003). Technologies such as organic fertilizers and soil conservation techniques are examples of technologies appropriate for specific problems such as limited access to fertilizers and soil erosion, respectively. Appropriate technologies are developed based on the resources available in the communities for adopters of the innovations to keep using it and sustain the adoption over time.

The analysis of the social system is also essential to diffuse these technologies among the networks. Communities and their members have structured networks with their respective opinion leaders and communication channels which can be identified and used to diffuse an innovation (Rogers, 2003).

This study confirms Roger's characteristics of opinion leaders that say that they heterophilous because they have greater exposure to mass media information and have social interactions with other networks. They can be either formal or non-formal leaders, who adopt innovations that are socially and culturally accepted by the system. These opinion leaders validate the innovations and influence followers to adopt them aver time (Rogers, 2003). These individuals are natural leaders who need to be empowered to support the diffusion process of appropriate innovations.

The diffusion of appropriate technologies to small farmers through opinion leaders is a proposed strategy to achieve sustained adoption over time. Two components

are essential, the participatory identification of the appropriate technologies by farmers and the validation of these technologies by opinion leaders. These components will facilitate the acceptance, adoption and diffusion of technologies by farmers and their networks to improve their agricultural systems and environmental conditions.

Implications

This study contributed a qualitative description of the complex conditions and needs of farmers of a specific area of Guatemala. Also, it provided research about environmental and social conditions of farmers in a real context through the use of multiple sources of information. Thus, the findings of this study contributed to applied theory about participatory needs assessments and social networks in real applications and conditions for an ongoing development project in Guatemala.

The limitation presented by this study was that it did not represent the diversity presented in the region of Chimaltenango. The study only includes participants from five different areas of the region; the other eleven areas were not represented.

It is recommended that further studies will include participants from other areas of the region. Also, it is recommended that other participatory methods and tools should be tested to define needs and identify appropriate technologies for small farmers.

Recommendations

Findings from this study pointed to several recommendations regarding the application of need assessments and the use of social networks to diffuse agricultural technologies in development projects.

Needs Assessment Process

The needs assessment was an important tool to plan and design a development project. A needs assessment is also an instrument to systematically gather perceptions, and needs from the farmer, his/her environment, and the farm system. The method should provide depth of physical, biological, social, and economical factors that affect the farmer's decision to adopt a technology. The needs assessment should integrate all the previous components with the internal and external interactions of the system. A needs assessment should provide an integrated perspective that allows the researcher or change agent to fully understand the system as a whole.

Data should be gathered from several individuals from different groups and communities to make sure that diverse situations are included and analyzed. Therefore it is recommended to address groups as well as individuals from different rural and urban settings of the region. The assessment of groups should be done at two levels, at the individual level and at the group level. The reason for this is that even though members are together as part of a group; they are different from each other and have different situations and goals. Thus at the individual level, members should be interviewed to gather their unique conditions. Furthermore at the group level, all members should participate and interact to reach joint decisions. To reach consensus about needs and priorities among a group it is recommended that the outsider or change agent uses participatory tools such as matrices for group evaluation.

Data gathered in a needs assessment should be analyzed as a whole to identify priorities. It is recommended that priorities be identified through participatory tools so

that the group or community takes the lead in the development process. This participatory process can sometimes be slow, but the results are worth it. Normally when the group is able to identify their main problem they will make sure that they find and sustain the solution.

Assigning priorities is the starting point for the identification or development of appropriate technologies. These technologies should respond to the local, cultural, and economical conditions of farmers and ensure the use of available resources. All of these actions are needed to achieve sustained adoption of technologies by farmers over the time.

Use of Social Networks in the Diffusion of Technologies

In addition to conducting a deep and inclusive needs assessment, another important recommendation is studying the social networks of the beneficiaries. Part of this study was the development of a strategy to identify opinion leaders among beneficiaries. This practical strategy is recommended to change agents for the purpose of selecting formal and non-formal leaders. These leaders need to be empowered to become aides of the diffusion process of appropriate technologies.

The diffusion of technologies through the structured networks provided by the rural and urban communities is very effective. Leaders and followers are familiar to, and respected by, their networks. Therefore, change agents are encouraged to become familiar with the networks and use the links and communications channels within these networks to get their message across. The identification and use of existing networks is

recommended to optimize resources of the project and duplicate the impact among the beneficiaries.

REFERENCES

Becker, M. H. (1970). Sociometric location and innovativeness: Reformulation and extension of the diffusion model. *American Sociological Review, 35*(2), 267–282.

Chambers, R. (1992). *Rural appraisal: Rapid, relaxed and participatory*. Discussion Paper 311. Brighton, UK: Institute of Development Studies.

Departmental Counsel for Development. (2007). *Strategic territorial planning 2008-2023*. Secretaria de Planificación y Programación.

Department of Education of Guatemala. (2007). Dirección Departamental de Educación de Chimaltenango. Retrieved September 21, 2009, from http://www.mineducchimal.gob.gt/

Dorward, P. T., Shepherd, D. D., & Wolmer, W. L. (1997). Developing farm management type methods for participatory needs assessment. *Agricultural Systems, 55*(2), 239-256.

Earthtrends. (2003). *Economic indicators Guatemala*. Retrieved August 25, 2009, from http://earthtrends.wri.org/pdf_library/country_profiles/eco_cou_320.pdf

Etling, A., & Smith, R. (1994). Participatory needs assessment: A key to FSRE. *Journal for Farming Systems Research-Extension, 4*(2), 45-56.

Feder, G., Just, R. E, & Zilberman, D. (1985). Adoption of Agricultural Innovations in Developing Countries: A Survey. *Economic Development and Cultural Change, 33*(2) 255-298.

Fliegel, F. C., & Korsching, P. F. (2001). *Diffusion research in rural sociology: The record and prospects for the future.* Middleton, WI: Social Ecology Press.

Food and Agriculture Organization of the United Nations (FAO), & International Plant Genetic Resource Institute (IPGRI). (2002). *The role of women in the conservation of the genetic resources of maize Guatemala*. Rome: FAO.

Ford, R. (2003). Planning and implementation. In Hazeltine, B., & Bull, C. (Eds.). *Field Guide to Appropriate Technology* (pp. 29-34). San Diego, CA: Academic Press.

Hartwich, F. M., Monge P. L., Ampuero L., & Soto, J. (2007). Knowledge management for agricultural innovation: Lessons from networking efforts in the Bolivian Agricultural Technology System [Electronic version]. *Knowledge Management for Development Journal, 3*(2), 21-37.

Hazeltine, B., & Bull, C. (2003). *Field guide to appropriate technology*. San Diego, CA: Academic Press.

Heemskerk, W. (2005). *Participatory approaches in agricultural research and development*. Retrieved July 17, 2009, from http://knowledge.cta.int/en/Dossiers/Demanding-Innovation/Participatory-approaches-in-ARD/Articles/Participatory-approaches-in-agricultural-research-and-development.

Hogset, H. (2005). *Social networks and technology adoption.* BASIS Policy Brief No. 6, Basis Collaborative Research Support Program, Cornell University, Ithaca, NY.

International Fund for Agricultural Development (IFAD). (2007). Agricultural innovation: Defining IFAD's role [Electronic version]. *Journal for Farming Systems Research-Extension, 4*(2), 45-56.

Knoke, D., & Kuklinski, J. H. (1982). *Network analysis.* London, UK: Sage Publications.

Kohler, H. P., Behrman, J. R., & Watkins, S. C. (2007). Social networks and HIV/AIDS risk perceptions. *Demography, 44*, 1–33.

Lincoln, Y. S., & González, M. E. (2008). The research for emerging decolonizing methodologies in qualitative research, further strategies for libratory and democratic inquiry [Electronic version]. *Qualitative Inquiry*, *14*(5), 784-805.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation.* San Francisco, CA: Jossey-Bass.

Monge, M., Hartwich, F., & Halgin, D. (2008). *How change agents and social capital influence the adoption of innovations among small farmers* [Electronic version]. Discussion Paper 00761. Washington, DC: International Food Policy Research Institute.

Municipal Information Service. (2009). Chimaltenango Department. Retrieved July 20, 2009, from http://www.inforpressca.com/municipal/mapas_web/chimaltenango/chimaltenango.php

Narayanasamy, N. (2009). *Participatory rural appraisal: Principal, methods and application*. Thousand Oaks, CA: Sage Publications.

National Institute of Seismology, Vulcanology, Meteorology, and Hydrology of Guatemala (INSIVUMEH). (2009). *Datos metereologicos de los departamentos*. Retrieved October 1, 2009, from http://www.insivumeh.gob.gt/meteorologia/ESTADISTICAS.htm

Olmstead, A. L., & Rhode, P. W. (2008). *Creating abundance: Biological innovation and American agricultural development*. New York, NY: Cambridge University Press.

Pebley, A. R., & Goldman, N. (1995). Social inequality and children's growth in Guatemala. *Health Transition Review 5,* 1-20.

Rhoades, R. E. (1987). Farmers and experimentation. Agricultural Administration (Research and Extension) Network. Discussion Paper No. 21. London, UK: Overseas Development Unit (ODU).

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York, NY: Free Press.

Rouda, R. H., & Kusy, Jr., M. E. (1995). *Needs assessment: The first step*. Retrieved September 5, 2009, from http://alumnus.caltech.edu/~rouda/T2_NA.html#other_articles

Rutatora, D. F., & Mattee, A. Z. (2001). Towards a farmer-centered extension service: the case of Uluguru Mountain Agricultural Development Project, (UMADEP) Morogoro, Tanzania. *Southern African Journal of Agricultural Extension, 30,* 89-103.

Schumacher, E. F. (1973). *Small is beautiful: A study of economics as if people mattered*. London, UK: Blond & Briggs Ltd.

Shaner, W. W., Philipp, F. P., & Schmehl, R. W. (1982). *Farming systems research and development*: *Guidelines for developing countries.* Boulder, CO: Westview Press.

Shinn, G. C., & Briers, G. E. (2009). *A framework for Iraqi pos-conflict agricultural development: A blueprint for action*. College Station: Department of Agricultural Leadership, Education, and Communications, Texas A&M University. Unpublished paper May 13, 2008.

Soils of Guatemala. (n.d.). Retrieved October, 2009, from http://www.doschivos.com/trabajos/sociales/705.htm

Staatz, J. M., & Eicher, C. K. (1998). Agricultural development from a historical perspective. In Staatz, J. M. & Eicher, C. K. (Eds.), *International Agricultural Development* (pp. 3-38). Baltimore, MD: Johns Hopkins University Press.

Stake, R.E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage Publications.

Sutherland, A. (2002). *Assessment of Participatory Rural Appraisal (PRA): The effects of practicing among development institutions and rural communities in Paraguay*. Unpublished doctoral dissertation, Texas A&M University. College Station: TX.

United Nations (UN). (1987). *Report of the world commission on environment and development*. Retrieved October 1, 2009, from http://www.worldinbalance.net/agreements/1987-brundtland.php

United Nations (UN). (2009). *The millennium development goals report, 2008*. Retrieved July 25, 2009, from http://www.un.org/millenniumgoals/pdf/The%20Millennium%20Development%20Goals%20Report%202008.pdf

Valente, T. W., & Davis, R. L. (1999). Accelerating the diffusion of innovations using opinion leaders [Electronic version]. *The Annals of the American Academy of Political and Social Science 566,* 55-67.

World Bank. (1996). *The world bank participation sourcebook, environmentally sustainable development.* Washington, DC: World Bank.

World Health Organization (WHO). (2000). *Needs assessment*. Retrieved September 1, 2009, from http://www.unodc.org/docs/treatment//needs_assessment.pdf

Yin, R. K. (2009). *Case study research: Designs and methods*. Thousand Oaks, CA: Sage Publications.

APPENDIX A

Institutional Review Board Approval to Conduct Research Study

TEXAS A&M UNIVERSITY
DIVISION OF RESEARCH AND GRADUATE STUDIES - OFFICE OF RESEARCH COMPLIANCE

1186 TAMU, General Services Complex
College Station, TX 77843-1186
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Human Subjects Protection Program — Institutional Review Board

DATE:	22-Jun-2009

MEMORANDUM

TO:	OLEAS, CAROLINA 77843-3578
FROM:	Office of Research Compliance Institutional Review Board
SUBJECT:	Initial Review
Protocol Number:	2009-0440
Title:	A Study Case of the Impact of Training on Small Farmers in Chimaltenango, Guatemala
Review Category:	Expedited
Approval Period:	22-Jun-2009 **To** 21-Jun-2010

Approval determination was based on the following Code of Federal Regulations:

45 CFR 46.110(b)(1) - Some or all of the research appearing on the list and found by the reviewer(s) to involve no more than minimal risk.
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(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation or quality assurance methodologies.

(Note: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b) (3). This listing refers only to research that is not exempt.)

Provisions:

This research project has been approved for one (1) year. As principal investigator, you assume the following responsibilities

1. **Continuing Review:** The protocol must be renewed each year in order to continue with the research project. A Continuing Review along with required documents must be submitted 30 days before the end of the approval period. Failure to do so may result in processing delays and/or non-renewal.
2. **Completion Report:** Upon completion of the research project (including data analysis and final written papers), a Completion Report must be submitted to the IRB Office.
3. **Adverse Events:** Adverse events must be reported to the IRB Office immediately.
4. **Amendments:** Changes to the protocol must be requested by submitting an Amendment to the IRB Office for review. The Amendment must be approved by the IRB before being implemented.
5. **Informed Consent:** Information must be presented to enable persons to voluntarily decide whether or not to participate in the research project.

APPENDIX B

Interview Protocol for Article "Participatory Needs Assessment of Small Farmers in Chimaltenango, Guatemala"

These questions will be used as a guide to interview small farmers to assess the needs of a group of participants of the AGTEC project in Chimaltenango, Guatemala. (Recommended time-1 hr.)

Research question 1. Physical factors

1.1 What are the major climatic characteristics that affect your farm/community?

1.2 What is the temperature like in your farm/community?

1.3 What are the main season and how long are them?

1.4 What type of soils are there in you community/ farm?

Research question 2. Biological factors

2.1 What the major biological factors that influence the health of your crops?

2.2 What the major plagues or diseases that influence the vitality of the crops on your farm?

2.3 Are weeds a threat for the growth of your crops?

Research question 3. Economical conditions

3.1 What are the major aspects of the economic setting that influence your farming system?

3.2 Do you have access to local, national or international markets? Are those markets constant?

3.3 Do you have access to credit and inputs for production?

3.4 Do you sell your products to intermediaries or final consumers?

3.5 Do you transport your product? If yes what are the transportation conditions?

Research question 4. Social characteristics

4.1 What are the social factors that influence farmers' acceptance of innovations?

4.2 What are the norms about land ownership?

4.3 What are the customs of division of labor, rights and obligations according to age and gender?

Research questions 5. Farming system

5.1 What do you know about alternative management practices, cropping patterns, sources of inputs, information and markets?

5.2 What are your beliefs, attitudes (emotions, feelings), and behaviors (past reactions or experiences) to may affect the adoption process?

5.3 What are your goals as a farmer?

Research question 6. Resources

6.1 Labor

6.2 Capital: equipment, buildings, others

APPENDIX C

Data Compilation by Categories for Article: "Participatory Needs Assessment of Small Farmers in Chimaltenango, Guatemala"

1. Physical factors

2-I. Mountain region, dry session lasts for seven months. The only information about the weather she has is what she has observed throughout the years, she mentioned not knowing exact or accurate data.

3-I. Changes in temperature occur during the day, it can go from 10 degrees Celsius in the morning to 25 degree Celsius at noon. Temperatures vary a lot during the day and not so much through the year. The temperature through the year is the same.

4-I. Rain and temperature are the most important factors. The rainy session goes from June-October, and the dry session goes from November-may.

5-I. Temperature and rain are the main climatic conditions that affect the farm. There have been big changes in the climate, before the rainy season was longer. At the present they have long dry season and less months of rainy season. Very long summers have caused droughts and a lack of water for the crops. The rivers have less water now, so the soil doesn't have that much humidity anymore.

7-I. The two main climatic factors are rain and temperature. They are keys for the growth of the crops.

8-I. Rainy session goes from May to October and the dry session goes from November and December. He doesn't have accurate information about the temperature and rainfall of his area, as he recognized that they don't have access to this information.

9-I. Temperature ranges from14-27 degree Celsius. Temperature varies during the day, from cold temperatures in the early mornings and night to hot temperature during noon. The highest temperature occurs from 12:00 pm -2:00 pm.

10-I. Annual average temperature 16 degree Celsius, December-February the temperature drops to 6 degree Celsius, rainy session 4 months. There have been changes in the length of the season and drastic drops in temperature during the last years. About the types of soils he mentioned that before there used to be more black soils which are more productive. Now there are few rich soils, those are the best.

11-I. Temperature: 6-23 degree Celsius Rainy season from May-September, dry season October-April. The climate conditions changes a lot every day, the seasons are not stable or predictable. Soils in slope areas are less productive (they produce two hundred pounds of corn per 84 meters) compare to soils in flat areas that produce eight hundred pounds.

12-I. May-August strong winds, droughts and frosts. In October of 2008 strong winds destroyed most of the corn plantations of the community. The changes in the climate are unpredictable and they don't know how to prevent damages in their crops. There are different types of soils. He recognizes them by the different colors, black are the richest type of soil.

15-I. There are a rainy and dry seasons. Temperatures are the same through out the year.

1-FG. Average temperature 14 degree Celsius. Dry season is increasing with the time. No water available for the crops.

2-FG. Rainy season goes from May-October and the dry season goes from November-April. March and April are the hottest months of the year. The average temperature in this area is 18 degree Celsius.

2. Biological factors

2-I. No plagues and diseases that affect the growth of her small animals

3-I. No significant problems in the health of his animals.

4-I. When producing one crop in bigger quantities I use different agrochemicals to control the different plagues and diseases that affect my crops. I control weeds with the use chemical herbicides.

5-I. In the tomato production there are nematodes in the soil which affect the development of the plants. To control weeds I use certain herbicides that are efficient.

7-I. No problem

8-I. No problems with plagues and diseases of the different crops.

9-I. The presence of nematodes and white flies is our biggest problem, when producing tomato inside the greenhouse. “We also have a problem with the tomato when it is growing; it presents black spots at the bottom of the fruit. Some people have told us that it is cause by the deficiency of a nutrient in the soil. To fix this we just need to add a specific fertilizer to the soil, which is easier than controlling any plague or disease”.

10-I. June Beetle can affect corn but it does not cause big problems to the plants. No agrochemicals are applied to control insects in corn. Weeds are manually picked by me or my kids.

11-I. Beans don’t grow very tall. The flower of the fava beans drops before it makes a fruit and I think it is because the soil has certain nutrient deficiencies that do not allow the plant to develop completely. I also have weeds that grow around the corn and beans, especially during the rainy season but I picked them manually.

12-I. Corn does not have plagues that significantly affect the development of the plant. Sometimes he had observed June beetles in his plantations. He controls weeds manually and does not use herbicides because he says they are too expensive.

15-I. “nematodes and white flies are the bigger problems they face in tomato production”

1-FG. There are not plagues or diseases that affect the growth of trees at the nursery where we reproduce and grow the different species.

2-FG. “The coffee berry borer is their biggest enemy when producing coffee”

3. Economical conditions

2-I. Because they don’t have legal paper about the ownership of the land, they cannot access to credits. Therefore she gets a credit from her association that will pay in 2 years, and the interest rates are low. She uses the credit to produce small animals like chickens and pigs for family consumption and the local market.

3-I. He produces cheese for the local market. He is in charge of the production, processing, marketing and transportation of the final product. He has a credit from his association to sustain his business. He locates and negotiates the local market for his product.

4-I. He produces french beans and snow peas, these crops demand the use of chemical fertilizer for the growth of the plant and agrochemicals to control plagues and diseases. He got a credit from the association to invest in his crops. He needs new markets for his product because he is not getting a good price from them, as he is selling his products to intermediaries. The roads to take the product to the market are in bad conditions and they are not safe.

5-I. He produces french beans and tomatoes. He invested in a greenhouse and irrigation system with a credit from the association. He uses certain agrochemicals and fertilizers that are bought in the store in the main town, these precuts are expensive. Now he sells his products to intermediaries at a low price, but he prefers this because he does not have a truck or any way to transport his products and the roads are not safe or good. He needs new markets for his product.

7-I. He got a credit to maintain his cattle. He has learned how to get more sub-products as the liquid and solid organic fertilizers. He uses and sell all the organic fertilizers or sub-products now.

8-I. The road to take the products to the market is really bad and not safe. The price that farmers get is really low, it does not cover the production cost. There are big markets like the one in Chimaltenango and Ciudad de Guatemala but it is hard for him to get there. The intermediaries pay a lower price to the farmer.

9-I. They have made different credits as a group to implement our projects. They have invest a lot for the greenhouse, irrigation system and tomato production. She stated “we don’t like to borrow money, but we are forced to look for credits to sustain our farm”.

They have stable markets for their product, but they are facing technical problems in the greenhouse production.

10-I. There are central markets where the products are sold; intermediaries are the ones that get the most. Chemical fertilizers such as 15-15-15 have increased their price and he cannot afford them anymore, he said: “we were dependent on the use of chemical fertilizers and now we need to learn about fertilizers that are effective and will cost us less”. He works with basic tools, no irrigation system, as he doesn’t have access to credits to invest in the farm. He plants at the beginning of the rainy season in April. Normally products like mine (corn and beans) are grown for family consumption.

11-I. Intermediaries come to the community in their trucks to buy the product to sell in the central markets. He doesn’t have access to the subsidized or free chemical fertilizer (15-15-15) anymore. He cannot afford buying chemicals at the market price, he don’t have access to credits. Corn and beans are produced for family consumption, sometimes when there are excesses of the product I sell it to the intermediaries that come to the community.

12-I. He produces corn and beans for family consumption. He uses chemical fertilizer and no agrochemicals to control plagues.

15-I. The market for our product is not a problem because there are a lot of markets around like the one in Chimaltenango and another in the capital city. She stated “having a constant market for our product has allowed us to plan our productions and get fair prices that cover our production costs”.

1-FG. They need a credit to start restart the reforestation project. They as a group they don't have funds anymore. The trees they grow for reforestation have a definite buyer already such as public and private organizations that will the trees.

2-FG. All the farmers of the group and the community produce coffee, so they think that they have saturated the market. The group is thinking in diversifying their production to tomato, to sell in the local market. There is a need for tomato and the actual supply comes long ways from other areas, so they want to cover this niche.

4. Social characteristics

2-I. Small farmers like her have a small piece of land, which she received from her family. Her father's land was divided into smaller pieces to be divided among all the brothers and sisters. She takes care of the small animals, as a secondary income for the family. Her husband supports her on this activity.

3-I. He bought a piece of land to have cows for dairy production. He is responsible for the production and his wife is in charge of processing the products.

4-I. He takes care of the production for the local market (French beans and snow peas) and his wife and kids help with the small animals and the family consumption products such as corn and beans. He works in his family land, which he received as inheritance from his father.

5-I. He is charge of the tomato production. The rest of the family helps growing the corn and beans for family consumption. His farm was part of a bigger farm which was owned by his father. The father's farm was divided among all the siblings of the family for them to work in agriculture, as his father did.

7-I. He doesn't own land, he rents a piece of land where he put his cattle for grazing.

8-I. The men normally work the land to produce corn and beans. The women are trying to have an independent source of income; therefore they organized themselves into a group to work in a greenhouse which was provided by MAGA. In the greenhouse the women work.

9-I. They as group rent the land. The group members are the labor for the farm, when there is too much work they pay people to work for them. They all have the obligation to work in the farm by being members of the association.

10-I. Small farmers work as labor for bigger farms that produce grains or in other activities. He works in a restaurant in the capital city.

11-I. Indigenous primarily produce corn and beans for family consumption. Women take care of the small animals. Family labor is used in the farm to produce corn and beans. He received this piece of land from his mother. He uses the same indigenous practices that his father and mother used.

12-I. He owns a piece of land here he produces corn and beans for family consumption. He works in the same way that his father did. The wife and children help in the daily activities of the farm.

15-I. They (the group) rent the land and work in the farm, they have a 10 year contract, they are aware that they will have to leave this farm in the future so they don't want to do a lot of investment in here. The group (women) has to come to the farm and help in the daily activities, when they are not able to come they can send someone to substitute them in the daily activities.

1-FG. The group bought land with funds provided by an international donor. All the members of the group in the reforestation project when they need to.

2-FG. Men and women are part of the association. Most of the members of the group own their piece of land. Normally members inheritance the land from their families and continue with the tradition of growing and processing coffee. When working in coffee men and women work at the fields.

5. Farming system- *Knowledge*

2-I. She learned about basic animal management (pigs and chickens), from a friend in the community. She observed and practiced different activities in her friend's farm. She has tried vermi-compost made up from animal manure. She knows how to sell her products in the local market.

3-I. He knows all about dairy production and cheese production. He knows about the markets of dairy products in the local market.

4-I. He uses chemical fertilizers to produce products such as snow pea and french beans. He knows about the use of chemicals products to kill plagues and diseases. He has learned all these techniques recently from extension projects. He does not have information about international markets.

5-I. He knows about intensive production of vegetables, which he learned from other extension agents from different projects. He wants to learn about improved agricultural practices, he stated: "activities, crops and practices are naturally learned from other members of the community or friends. We should lead by example, and once we show

results, others will follow us". He does not have information about international markets and he also wants to learn about access to them.

7-I. He knows about animal production, use of manures for solid and liquid fertilizer. He knows about prices of organic fertilizers and possible consumers for these fertilizers in the local market.

8-I. She knows about flower and tomato production under greenhouse. She learned about the preparation and use of organic fertilizers such as bokashi, vermin-compost and compost. She learned all these new techniques from training in different projects. She does not have information about national specific markets.

9-I. She has learned about basic skills for greenhouse and intensive production. She has also learned about vermi-compost and liquid organic fertilizers to use them in different crops. She had practices dairy and chicken production.

10-I. He knows about mixed production of corn and beans for family consumption.

11I. He knows about family consumption production, small plots of corn and beans with the use of basic agricultural practices.

12-I. He knows to produce corn, beans, and fava beans. He knows how to produce with no chemical products to produce plagues and insects

15-I. She knows about dairy production and production of different crops such as fava, corn, beans and tomatoes. She stated: "I do all what my father taught me". His father was a farmer and she always helped him in the farm and learned to be a farmer from him.

1-FG. They have learn about reproduction and maintenance of fruit trees and reforestation trees.

2-FG. They know about coffee production. They grow coffee as a monoculture. They are familiar with the use of chemical fertilizers for production. They know about quality standard and prices of coffee in the national markets.

Beliefs

2-I. Small animal production has not given her significant increase of income in the past. So she believes that it is not possible that improved management skills can help her improve.

3-I. He does dairy production because he believes that is what he really knows how to do well.

4-I. He believes farmers can produce specialized products but he believes the marketing of the products is really hard to get accomplished.

5-I. He has learned to produce non-traditional products but be believes that without identified markets, nothing will work for him.

7-I. He believes that dairy production is very productive, because he can produce several products from it such as the meat and organic fertilizers.

8-I. She believes women have been discriminated and that little by little men are accepting their rights and participation. She believes that all women can improve through education. She also believes that agriculture is a source of food for family consumption but she does not think that by improving agricultural production techniques, her and her family will be able to increase their monthly income. Her and her

group tried organic fertilizers in the past and they are not doing it anymore. Her explanation was that she “believed that it was time-consuming and that they didn’t have the materials available in their farms to do the fertilizers”.

9-I. She believes that everyone should contribute for their own development. In order to do this all farmers should all be entrepreneurs and see agriculture as a business. She stated: “I see myself as an entrepreneur and I wish that all farmers will have the opportunities we have”.

10-I. He believes that all farmers need support but not all want to work together or learn new techniques. He also believes that is hard to improve just with the production of corn and beans. But he stated: “if I see that the demonstration works, then I will apply it in farm and even teach it to others; but, first, I have to see it”.

11-I. He thinks that a farmer should be interested in order to learn and apply new techniques. He also thinks that agriculture cannot be the only source of income for his family because it is not enough.

12-I. He believes people need to be open to try to learn new techniques. He thinks not all farmers are ready to change. He believes it is hard to increase his income just through agriculture.

15-I. She believes working in groups is very important and the support of the group is also essential to go through the process of change. She believes that her group sees agriculture as an opportunity to increase their income as a group and as individuals.

1-FG. They believe reforestation should be a priority because there is not enough water to do agriculture.

2-FG. They believe coffee is not a productive crop anymore; too many farmers are producing it. They believe that if they diverse their production they will get better prices of a new product.

Goals

2-I. Her goal is to have access to a bigger credit to make her small business bigger. Her small animal production is working and she wants to grow.

3-I. He would like to get more people interest in getting credits with the association so more would benefit.

4-I. In terms of agriculture he wants to receive technical assistance to properly manage his crops from planting to harvest. He wants to have stable markets for their products. In terms of the credit group he wants to have more support from ASDEA, as far as having technical assistance to all members, follow up of the application of the credits to the members, having constant communication between presidents of the different groups to exchange success stories and practices. In general he proposes more communication between the board of directors and the members of the group.

5-I. He thinks they need technical assistance to improve the agricultural practices to produce crops for export. And we need a storing center to gather, store and maintain the product before selling it in national or international markets.

7-I. He wants to get markets for his products that would pay a good and stable price.

8-I. Being able to provide education for all my children. At the present the girls don’t want to go to school because it is not safe for them to travel to Parramos everyday.

Also the women of our community need to get together and receive support to create and implement small businesses based on their agricultural productions.

9-I. Get the farm going, having a better production of vegetables and being able to sell in international markets, she wants to be an entrepreneur.

10-I. Own land and have more resources available to do organic agriculture to produce better corn and beans.

11-I. He wants to learn more about organic techniques to control plagues and diseases in different crops such as corn and beans.

12-I. He wants to reduce the use of chemical fertilizer in the long run and not depend on it, as it has such a high price.

15-I. She wants to pay the credit that we did as a group to build the greenhouse and have a successful production from the greenhouse.

1-FG. They want to get the funds to restart the reforestation project.

2-FG. They want to diversify their production. Get the funds to start a tomato project and being able to offer the product in the local markets.

6. Resources- Labor

2-I. Family labor

3-I. Family labor

4-I. Family labor

5-I. Family and paid labor

7-I. Family labor

8-I. Group labor

9-I. Group labor

10-I. Family labor

11-I. Family labor

12-I. Family labor

15-I. Group labor

1-FG. Group labor

2-FG. Family and paid labor

Capital

2-I. She does not have equipment. She just has a small pen built to keep the pigs.

3-I. He has milking parlor, equipment for cheese processing and a refrigerator to store the final product.

4-I. He has a sprayer and tools such as shovel, mattock and machete.

5-I. He has a greenhouse, irrigation system

7-I.

8-I. He has a greenhouse and he built and irrigation system for the greenhouse.

9-I. They rent a piece of land, they built tanks to capture water and a greenhouse with a drip irrigation system.

10-I. Basic tools like a shovel, mattock, sprayer and machete.

11-I. Basic tools like a shovel, mattock, sprayer and machete.

12-I. Basic tools like a shovel, mattock, sprayer and machete.

15-I. They rent a piece of land, they built tanks to capture water and a greenhouse with a drip irrigation system.

1-FG. They built a tank to capture water and a little greenhouse to reproduce plants.

2-FG. Each farmer owns a sprayer and other basic tools such as shovel, mattock and machete.

APPENDIX D

Interview Protocol for Article "A Case Study to Select Opinion Leaders to Diffuse Agricultural Innovations in Chimaltenango, Guatemala"

These questions will be used as a guide to interview small farmers to assess the social networks of participants of the AGTEC project in Chimaltenango, Guatemala. (Recommended time-1 hr.)

Research question 1. Personal story

1.1 Roles as a leader in community

1.2 Role as a leader in agriculture

1.3 What have you done to improve agricultural production in your community?

Research question 2. Social Networks

2.1 If you have a question about agriculture (production, marketing) who would you ask first?

2.2 Are you a member of an association or cooperative?

2.3 Do you have friends or family who practice innovative agricultural activities?

2.4 Do you regularly interact with extension agents or local staff an NGO?

Research question 3. Characteristics of leaders and followers

3.1 How do you work as a leader?

3.2 Successful experiences in selecting beneficiaries and implementing projects

Research questions 4. Training evaluation and diffusion rate

4.1 How did you find out about this training?

4.2 Was the training topic received appropriate for you current needs?

4.3 Would you share what you learned today with other people in your community? Why?

Research question 5. Adoption rate of training

5.1 Have you seen this practice applied before in another farm?

5.2 How difficult do you perceive this practice to be?

5.3 Do you feel that you can test this practice reasonably at your farm?

Research questions 6. Sustainability

6.1 Can you continue doing what you are doing?

6.2 What change is needed to sustain your life?

APPENDIX E

Data Compilation by Categories for the Article "A Case Study to Select Opinion Leaders to Diffuse Agricultural Innovations in Chimaltenango, Guatemala"

1. Personal story- *Roles as a leader*:

1-I. In 2001 she was hired by the municipality to coordinate the water department. In this position she also coordinated the women's group activities. She started visiting urban and rural areas to discuss their needs, people started trusting her. She also invited women of the area to be part of the women's group. In March 2009, she was assigned to the Women Office, which is part of the municipality.

As part of my job I provide support and counseling to women of the community that require help in different situations (medical, legal and social problems). I also make contacts to seek for funds to accomplish development project with the women's groups of the town. I also help implement projects at the local level.

2-I. I coordinate a group of 5 people to receive the credits. We as a group respond for the credit, so we all have the responsibility of paying the interest rate on time. My responsibility as a leader is to make sure that all the members are paying and that they are successful at applying their credits.

6-I. I am the vice president of the association and a member of the board of directors since last year. I support the president in all the activities of the group. Some of the activities are making new contacts and negotiating support from different organizations such as NGOs and municipalities. I also talk to new possible members to inform them

about our activities, goals and objectives to get them in the group. I try to give opportunities to individuals that have not been helped by other groups.

8-I. I am the president of the Cocode (Consejo Comunitario de Desarrollo-Community Counsel for Development). I have got together with the women to talk about their main needs and define priorities. Later I have talked to the mayor to communicate him our needs and see if he can help us.

My responsibility as a leader of the community is to communicate information, news and projects to the people of the community. To do this I go around the town knocking their doors and communicating important messages to them. Sometimes I also get the help of the local mayor, who also helps me to contact all the people and communicate the information.

The women of the community elected me as a leader because they wanted to have a representation in the community. We want to be considered make decisions that would help us develop and grow as individuals.

9-I. I am president of the AGEDI (Asociación de Desarrollo Integral Guatemalteco). As a president I make contacts with other organizations (NGOs, local and national authorities) to look for funds to support the design and implementation of economical projects for the members of the association. Our association is part of the CEDIG (Centro de Desarrollo Integral de Guatemala) which is part of the FEDENMURG (Federación Nacional de Desarrollo de la Mujer Rural). All these organization support the activities that our group does.

At the present, AGEDI has 22 members who are women and men of the area of Parramos. We rent a piece of land where we have cattle, different crops and one greenhouse. The maintenance of this area is responsibility of all members of the association therefore all the members are involve in the day by day activities and decisions. Our goal as a group is to accomplish successful economical activities such as exporting agricultural products. She stated: “as a president, I make contacts with other organizations (NGOs, local and national authorities) to look for funds to support the design and implementation of economical projects for the members of the association”.

10-I. He is the secretary for the COCODE. He helps the president to coordinate meetings with the community members. He also supports the implementation of different projects such as the distribution of food among the members of the community.

11-I. I am the president of the COCODE (Community Committee for Development) since 2002. I work with the people to try to alleviate their social, economical and environmental problems through the implementation of projects.

12-I. I am the mayor’s assistant. My main responsibility is to be the link between the municipality and our community. The mayor and I have a constant communication, we discussed possible projects and I tell him our needs and we define priorities for the community. Later I communicate the results to the community members through meetings and organize the implementation of the projects.

13-I. My role as a leader is to facilitate information, processes and projects with people from seven municipalities such as Tecpan, Santa Apolonia, San Jose Poaquil, Patzicia, Patzun, Balanya and Comalapa.

15-I. I am a member of the association since 1995 and I have been supporting the implementation of the different projects. The people in the group have changed a lot through the years but I am one of the 5 members that have been with the group since the beginning. Therefore I have been part of the growth of the group.

1-FG. We are all member of Association El Porvenir. 1) My wife is the president of the group. 2) I was the treasure of the group for the last eight years.

2-FG. We are members of the ADIY (Asociación de Desarrollo Indigena de Yepocapa-Association for the development of indigenous of Yepocapa).

Role of a leader in agriculture

1-I. I support agricultural and reforestation projects by looking for funds to implement community projects.

2-I. I grow pigs and chicken and sell them in the local markets to increase the economic income of my family. I have a small family, my husband and one daughter.

6-I. I am not involved in agriculture, my major economic activity is to make handicrafts such as shirts.

8-I. The men are the ones in charge of the agricultural activities, they produce corn and beans. Me and 14 other women from the community got together and formed a group called “Asociación Nueva Amanecer”. We build a greenhouse where we produced flowers and then tomatoes. At the present we are producing tomatoes.

9-I. The association manages the association’s farm and we want to effectively produce different products for international markets.

10-I. As a formal leader he is in charge of selecting beneficiaries and doing a follow up of the training sessions about improved agricultural practices offered by the municipality and different organizations.

As a farmer leader, he produces corn for his family's consumption. He wants the production to increase and the product to have a better quality. He tries new agricultural practices and if they work he would share them with other farmers for them to learn too.

11-I. I produce corn for family consumption. My role as a leader is to support farmers to learn and apply agricultural techniques to increase their productivity and protect the soil's fertility. I also make sure that farmers practice what they have learn and apply the techniques in their farms. As a group we discuss best practices and identify farms which are applying them to coordinate visits with other farmers who are interested so they can observe them.

12-I. I am a farmer and I have five "cuerdas" where I produce corn, beans and lima beans. The production is used for family consumption. I use traditional agricultural techniques but now I am trying to learn about organic fertilizers. My role as a leader in this training process is to receive the training and later I will apply it in a small scale in my farm. If it works I will practice it in a larger scale and if it works I will share it with more people from the community.

13-I. I contact rural students and search for funds that will be used in scholarships for them to receive practical education about effective agricultural practices such as greenhouse management.

15-I. I have farmed corn and beans since I was a child when I used to help my mother. At the present we produce these products for family consumption. I have been learning a lot through trying different techniques at the association's farm.

1-FG. We all produce small amounts of corn and beans in our farms for family consumption.

2-FG. We produce coffee as a primary crop and now we want to diversify our production by planting tomato.

What have you done to improve agricultural production in your community?

1-I. Start the implementation of a microcredit program with 6 groups of women from rural communities of Parramos. The credits help the women to invest in vegetable production as an extra income for their families.

2-I. I have talked with other members of the community about the adoption of receiving credits through the association to invest in agricultural projects.

6-I. Provide credits to small farmers for them to invest it in agricultural projects.

8-I. We have requested for technical assistance from engineers from MAGA (Ministerio de Agricultura, Ganadería y Alimentación- Department of Agriculture, Food and Livestock). We have also tried different products in the greenhouse.

9-I. We work together as a group in the farm and hopefully this will be a demonstration for the rest of the community members.

11-I. Share what I have learned with other community members and support them during the implementation in their farms.

12-I. Invite technicians to provide technical assistance and coordinate training sessions for the community members. Also try new agricultural practices in my farm to test the results and if they work I will transfer the results to others.

13-I. Contact families from the different communities and select students to be part of the educational program taught by Utz-Samaj.

15-I. Try new agricultural practices in the association's farm such as greenhouse production to learn how they work. In addition I have invited others to join the association for example her daughter Milvia Estrada is part of the group, because of her influence.

She has contacted more people to work for the project, but later she has convinced them to stay as part of the group. The new members don't have a job and they are interested in participating in the productive projects such as the tomato production that we are doing.

1-FG. As a group we have been planting trees to protect some water sources of the area.

We are trying to preserve the water in the long run.

2-FG. Discuss options as a group for agricultural diversification and look for funds to implement the new tomato production.

2. Social Networks- *If you have a question about agriculture (production, marketing) who would you ask first?*

1-I. N/A

2-I. I would ask to the other members of the group who also produce pigs or chickens.

6-I. To Genaro Calan, president of the association or other members of the association that are involve I agricultural activities.

8-I. My husband who is a farmer.

9-I. My husband-Jorge Salazar.

10-I. Esteban Xator, he has a lot of experience in the production of broccoli, carrots and other vegetables. He has a lot of contacts to sell the products in a good price.

11-I. When I have a question I ask it to the older person in the community who is Luciano Larez, because he has a lot of experience as he has farmed all his live.

12-I. Efrain Esquit and Esteban Xator.

13-I. N/A

15-I. Jorge Salazar- Sigda's husband.

1-FG. Technicians that work in INAB.

2-FG. Other members in the association, who have more experience than us, like Julian Loch Raxjal who is also a COCODE (Community Counsel for Development) of Yecocapa.

Are you a member of an association or cooperative?

1-I. No

2-I. Yes I am member of ASDEA.

6-I. Yes I am part of the board of directors of the association.

8-I. Yes I am a member of the Asociación la Nueva Aurora, which is a group of women that got together to do agricultural projects that would bring us extra economic income for our families.

9-I. Yes I am the president of AGEDI and member of the board committee of FEDENMURG.

10-I. No I am not part of any group, as there are not organized groups in this community.

11-I. No

12-I. No

13-I. No

15-I. Yes-AGEDI

1-FG. YES-El Porvenir

2-FG. Yes-ADIY

Do you have friends or family who practice innovative agricultural activities?

1-I. No

2-I. Yes as each of the members of the group produce different crops and animals.

6-I. Yes, some farmers produce vegetables such as broccoli and snow pea.

8-I. Not really, because people here don't like to try new things, they do what they have done for years.

9-I. Yes, my husband.

10-I. Yes, Esteban, Jacinto and Jesus Xator.

11-I. Yes, Esteban Xator.

12-I. Yes, Esteban Xator is an innovative farmer. He has produced all kinds of vegetables such as broccoli, beat and snow peas. He also has different contacts to commercialize the products, so he brings them here so other farmers are also producing vegetables to sell them to these contacts.

13-I. Here in the center we practice innovative techniques to produce tomatoes under greenhouses with proper irrigation systems and fertilization programs.

15-I. No

1-FG. No

2-FG. Not really, most of the farmers in the area produce coffee using traditional agricultural techniques.

Do you regularly interact with extension agents or local staff an NGO?

1-I. Yes in a daily basis in the municipality and in training sessions.

2-I. Just with the people that come through the association.

6-I. Yes, as part of my role as a leader of the association I am always in contact with people from other organizations and local authorities.

8-I. Sometimes we interact when they come to our community, which happens every month or two.

9-I. Yes because of my role as a leader for the two organizations (AGEDI, FEDENMURG).

10-I. A little more now that I am a recognized leader of the community.

11-I. Sometimes when they come to the community through the request of the municipality.

12-I. Not regularly.

13-I. Yes, different NGO and local authorities visit the center to find out about the programs we are doing with farmers and students.

15-I. No

1-FG. Two members said no and one said yes she explained that this was when she was part of the board of directors of the association.

2-FG. No

3. Characteristics of leaders and followers- *How do you work as a leader?*

1-I. “I don’t work alone, I am sure would not accomplish anything by myself”. I always make contacts “who are the ones that help me look for funds to implement new development projects. I also work through the authorities of the rural communities, who know their people, and they help us diffuse the information”.

Working for the Municipality has helped her to gain respect from the people. “Once the people know that I represent the local authority, they trust me”

Best practices as a leader

She thinks that in order to get support from other organizations the people in the community needs to be organized into groups. This is why she has supported the women’s groups of the area, she says “little by little we will make that all women in the town are united”.

2-I. In order to be a good leader a person has to support his/her peers, be honest, be open and share best practices with others.

From my experience of being the leader of the credit group I have learned to help others and this has helped to become leader of other organizations such as the church and the school committee.

6-I. I was elected as a leader of the organization because the members have seen my constant and active participation; also I am always on time to support the organization’s activities. In addition I have been able to obtain external funds to support training activities for the members.

8-I. A leader should share all the information with all the community members for their well being. In my case when there is a project or activity I make sure I contact everybody in the community. I have different ways of doing this, I go around the town knocking people's doors and I personally talk to them. Sometimes I also get the help of the local mayor, who also helps me to contact all the people and communicate the information.

The women of the community elected me as a leader because they wanted to have a representation in the community. We want to be considered to make decisions that would help us develop and grow as individuals.

9-I. I think a leader should be loyal, dynamic, dedicate enough time to his/her followers and activities and most important he/she should do it because he really believes in it and it comes from his/her heart.

10-I. A leader should share best practices with others and teach what he has learned. He should look for people that want to learn as not everybody is interested on learning new things.

11-I. A good leader should teach, reinforce what people have learned and support the application of new knowledge and skills.

12-I. Leader should teach other people that are interested in the topic. I teach what I learn.

13-I. Facilitate opportunities provide access to resources and support the process. Local leaders are trusted by the people of their communities.

15-I. A leader should be honest for people to trust him.

1-FG. A leader should always be there to help others and should have good communication skills.

2-FG. A good leader is the one that calls all the members, helps them, and explains information.

Successful experiences in selecting beneficiaries and implementing projects

1-I. “People started trusting me when I did specific projects with concrete results. Even the projects were small in funding they were important to gain the trust of the people” She negotiated the funds to start a project called “Techo mínimo” (Minimum roof) to built houses for poor people of the rural areas of Parramos. She did the follow up for the funds, received the materials and selected the beneficiaries. 100 families were chosen based on their economical needs, therefore families that didn’t have a house were chosen first. After people from the rural areas saw results from her work, they started trusting her. Other activities that build confidence in the people were: working to reduce the wastes around the urban areas. She is also supporting the implementation of a microcredit system (Grameen Bank) in 3 communities of Parramos.

2-I. I follow up with the members of my credit group to know how they are doing and ask if they have problems that I can help them solve. This has prevented bigger problems at the end of the month when all of us have to pay the monthly interest rate.

6-I. I am always open to people and I communicate the successes of the organization so others can join us. Also I approach people that have not being helped by other groups or projects; therefore I try to give opportunities for everyone in my community.

8-I. The association's projects have been successful because we share the cost with the members. For example, we provide training, food and credits to the members, but they have to contribute with their time and transportation costs for all the meetings. In this way, the members are committed because they are investing in their own future.

9-I. Practical training is the most appreciated by the members because it motivates them to participate and it helps them to develop their own knowledge. In our case the most successful and adopted project was when we learned how to do hydroponic production, as this fulfilled our needs at that time. She stated: "nobody learns from others' experiences, therefore; the importance, of accomplishing our own experiments and projects like we do in our demonstration farm".

10-I. "For a project to last over time and be sustainable it should start small, where we can observe and monitor results, and later reproduce the knowledge or skill to others"

11-I. In our community in order to share experiences, one farmer applies a new technique and then we coordinate visits for others to go, observe, discuss and analyze the results. If they like the results they will use the technique in their farms. It is important to select the people that are interested and not waste time with people that don't want to learn and have no interest.

12-I. Communicate efficiently between the mayor and the community members. Work as team with other leaders of the community.

13-I. Develop proposals that respond to the local needs. To look for beneficiaries I look for people and they provide me with references about others. I trust their organizational, political and social systems so I work through it.

15-I. Our biggest success has been the milk production we had in our farm because we knew how to do it and it was not a risky investment.

1-FG. The association was able to get the support of three organizations, the government of Japan, INAB (National Institute of Forest) and the FIS (Social Investment Fund). They provided us with a piece of land, water and seeds to start the reforestation project.

2-FG. Work as a group to search for new agricultural options such as the tomato production.

4. Training evaluation and adoption rate- *How did you find out about this training?*

1-I. Other leader from another municipality recommended her as a leader in the community of Parramos to the technician of the AGTEC project.

2-I. Through the association and the monthly meetings we have.

6-I. Through Pedro Villatoro who is an independent consultant that has been supporting the association since last year. He provides us with new contacts for new sources of funding and has helped the development of the association.

8-I. Through the Municipality (the mayor's wife) contacted me.

9-I. Through the FEDENMURG who was contacted by Pedro Villatoro (independent consultant for AGTEC) and the technicians of the AGTEC project.

10-I. Through our local authority, the auxiliary major, Efrain Cornelio Esquits.

11-I. Through Jose Hernandez, a staff member from MAGA.

12-I. Through the staff members of MAGA.

13-I. The director of the center was contacted by the staff of the AGTEC project. They offered training sessions and technical assistance.

15-I. Through FEDENMURG, as our association is part of the Federation.

1-FG. Through a consultant from the AGTEC project who is providing us technical assistance to plant and reproduce trees and implement a reforestation project.

Was the training topic received appropriate for you current needs?

1-I. We learned about the importance of reforestation. The topic is very important and appropriate for us (the town) as the municipality is working to protect the natural sources of water.

2-I. I have not received training from the AGTEC project yet. I have received training sessions about vermin-compost which has helped me in my daily activities at the farm to deal with the organic materials produced by the animals. I have also received leadership training which has helped to be a better leader for our credit group.

6-I. We have not received a training yet. As far as today we have had different meetings to negotiate the implementation of a greenhouse to produce tomato plants for the members of the association.

8-I. Yes, learning different techniques of sewing is going to help us do our own clothes and do some for the local market. This can be an extra income for our families.

9-I. Yes because we want to produce a better product. Therefore an organic production will have a better price at the markets and provide a better income for us. Organic products will allow us to reach new markets and at the same time we will produce a healthier product for the consumer.

10-I. Yes it was really appropriate because we cannot afford the chemical fertilizer anymore and we need to learn about organic fertilizers which are more effective and cheaper.

11-I. Yes it was really appropriate as I want to do a transition from chemical fertilizer to organic products.

12-I. Yes because I want to reduce the amount of chemical fertilizer that I am using in my farm's soil. The fertilizer is too expensive and I can not afford it anymore.

13-I. The educational program includes organic topics such as solid and liquid fertilizers, and integrated pest management. Therefore it is appropriate for the students and farmers to learn these topics in a practical way.

15-I. It was really appropriate because we are trying to learn new techniques that would help improve the green house production.

1-FG. Organic agriculture is really appropriate because we want to produce our own fertilizers to produce more corn and beans and we also want to learn about integrated pest management to control the pests in corn and beans.

2-FG. The workshop about organic agriculture is very appropriate for us as we want to learn about new techniques to produce a better product. We are also interested in the next workshop about marketing of agricultural products as our biggest problem is the lack of markets for our product.

Would you share what you learned today with other people in your community? Why?

1-I. Yes, this is why we called 80 women from Parramos to be part of the training sessions and be part of the reforestation in the municipality's land.

2-I. Yes I always try to share with others the best practices I have.

8-I. If anybody asks me about the sewing techniques I will teach them as they taught me.

9-I. Yes I will share it with anybody that wants to learn.

10-I. Yes I would share it with the people that want to learn new techniques. I first want to try it and if I have good results I want to share it with others so they can also do it.

11-I. Yes I would share what I have learned because I want people who are interested to improve their agricultural production. I will share the information with my son, my daughter, and my nephews.

12-I. Yes because as a leader I have the commitment to share what I learn. I will teach to the people that want to learn and show interest about the new topics, like Enrique Vargas my brother. I will not teach people with no interest.

13-I. Yes

15-I. Yes, I have shared it with the other members of the association.

1-FG. Yes we will share the information with all the members of the association. We were selected for this workshop with the condition that we will teach them what we have learned. Therefore by using the power point presentation that was used during the workshop we will be able to show it to the other members of the group and they will learn it too.

2-FG. Yes we would share what we learn here with the other members of the association.

5. Adoption rate of training**-** *Have you seen this practice applied before in another farm?*

1-I. Yes we already planted trees in that area eight years ago. We know reforestation is important to preserve the water.

6-I. We don't produce our own plants, we buy the plants from others.

8-I. Some farmers have done and applied organic fertilizer but they are not doing it anymore because they think it takes to much time for the fertilizer to decompose.

9-I. No

10-I. This technique I have not seen it yet. Some farmers in the community have used chicken manure and they have had really good results. Now I want to try this type of fertilizer.

11-I. I have seen the application of chicken manure for corn production.

12-I. I have seen the good results from using chicken manure in broccoli and other vegetables.

13-I. Yes we already produce vermin-compost with different methods. We provide worms for the farmers to start they own production.

15-I. I have heard that other people in the area are using organic fertilizers but I have not seen the results in the plant or production.

1-FG. No

2-FG. Yes I know there are coffee farmers in our area that have used organic fertilizers in their farms, but we have never learned how to do them and we want to learn.

How difficult do you perceive this practice to be?

1-I. It is not difficult because we have done it and we will do it again.

6-I. It seems difficult because we have never done it and we don't know how to do it. But we will receive training on how to reproduce plants and maintain the greenhouse.

8-I. The technique is not difficult but it requires a lot of labor and time to get it done.

9-I. It is not difficult to do the organic fertilizers as we learned by doing them. But we have not tried them on our plants so we want to know the final effects in the growth of the plant and final product.

10-I. It is not difficult, I will practice it again in my farm.

11-I. At the beginning it was difficult because I did not know the techniques, but after I did them it is getting easier. Now it is easy for me.

12-I. It is easy because we already did it and I am going to be able to do my own fertilizer.

13-I. It is not difficult, farmers learn faster by observing the different examples we have. Later we provide them with worm for them to start producing vermin-compost in their farms.

15-I. It is not difficult as we already practiced the vermin-compost and the liquid fertilizer in the association's farm.

1-FG. It does not sound difficult but we will have to try it in our farms.

2-FG. It sounds complex as we have learned just the theory but now the biggest challenge will be to do it in our farms.

Do you feel that you can test this practice reasonably at your farm?

6-I. This will be a group project, so we are not going to practice it individually in our farms.

8-I. Yes, we already tried it in the greenhouse to produce the flowers.

9-I. Yes we have done two different fertilizers in our farm because we had all the materials required. To try them we are going to start applying the fertilizers in small quantities of different crops to test them, if they work we will use them for all the production.

10-I. Yes I can test as far as I get the materials to do it, because here we don't have all the materials available.

11-I. Yes

12-I. Yes because I will try it in a small scale to observe the results, so I will not risk so much.

15-I. Yes, we already did.

1-FG. Yes

2-FG. Yes, but we might try it first in one farm and later when we observe the results we might try in the other farms as well.

If someone in your community test or adopt the innovation first, would you try it later in your farm?

6-I. Yes

8-I. Yes

9-I. Yes we would try it in our farm based in others' recommendations.

10-I. Yes

11-I. Yes

12-I. Yes if the results are good.

13-I. This is why we do demonstrations in the center, so the farmers and students can see the result and then they feel confident of applying the techniques in their farms.

15-I. Yes we always try new things that can help us boost our production.

1-FG. Yes

2-FG. Yes

6. Applicability of training- *Can you continue doing what you are doing?*

1-I. Yes, I have been supporting the growth of the women of Parramos since 10 years ago, and I will keep on doing it.

2-I. Yes I can continue to be the leader of the group. I have learned to teach them how we have to work and support them during the process.

6-I. Yes, I will be part of the board of director of the association for the next 2 years. And by receiving the group credit I will keep on manufacturing handicrafts.

8-I. We don't know if we are going to continue with the greenhouse production because at the present we don't have money to invest in it. But we will keep doing the "bordados" as a side economic activity.

9-I. Yes, can be a leader of my organization as far as I have the support of my family and the group. In terms of the work of the organization in the agricultural activities of the farm we need funds to generate sustainable projects. Our main need at the present is to find water for the agricultural production.

10-I. I have changed my agricultural practices because of the price of the chemical fertilizer.

11-I. Yes I can continue being a leader and a farmer.

12I. If I produce and apply organic fertilizer I will be able to keep on farming. But I can not farm just using chemical fertilizer.

13-I. Yes because I know the people from the different communities, local authorities and their situations. We have built a strong relationship of trust which has help for the implementation of the different projects.

15-I. We can continue the greenhouse production as far as we have technical assistance and a continuous source of water.

1-FG. At the present we can continue, as we are going to receive new funds from the project to continue the reforestation project. But we stopped producing and planting trees because we did not have funds to buy the seeds.

2-FG. Yes we can continue with the coffee production but the low and unstable price for coffee is a problem for us.

What change is needed to sustain your life?

1-I. “To sustain development we need to get together and educate the children”

2-I. I would like to have access to a bigger credit to make my small business bigger. My small animal production is working I want to make it bigger and grow.

6-I. Find national and international markets for the handicrafts I produce.

8-I. Being able to provide education for all my children. Also support the women of our community to get together to develop and implement small businesses for them to be independent.

9-I. Start implementing productive projects that are sustainable. Get more people involve in the association and as a leader, create economic projects that will benefit the women and men of my community.

10-I. Own land and have more resources available to do organic agriculture.

11-I. Learn more about organic techniques to control plagues and bacteria in different crops such as corn and beans.

12-I. Reduce the use of chemical fertilizer in the long run and not depend on it, as it has such a high cost.

13-I. Funds to provide more education and projects for the people of the rural areas.

15-I. Pay the credit that we did as a group to build the greenhouse and have a successful production from the greenhouse.

1-FG. Built a greenhouse for tree reproduction and make profits out of it so we can sustain the reforestation project

2-FG. Obtain technical assistance and funds to start producing tomato.

APPENDIX F

Peer Debriefing Memorandum

TO: Ing. Rudy Navichoc
FROM: Carolina Oleas
SUBJECT: Description and categories of the sample
DATE: July 22, 2009

Good morning,

This memo provides a description of the current status of the research "Participatory needs assessment of small farmers in Chimaltenango, Guatemala" (1st. article) and "A Case Study to Select Opinion Leaders to Diffuse Agricultural Innovations in Chimaltenango, Guatemala" (2nd. article). First, I will explain the status of the research process, then I will provide details about the sample, and finally I will name and describe the categories.

Current Research Situation

Data have been collected from nineteen different sources using different methods such as person to person interviews, dialogues and focus groups.

Demographics of the Sample

		Method		**Gender**		**Ethnicity**		**Age**	
	Number of Individuals	**I**	**FG**	**F**	**M**	**Indi-genous**	**Ladinos**	**Less than 30**	**More than 30**
1st. Article	16	11	2	8	8	4	12	2	14
2nd. Article	15	10	2	10	5	6	9	4	11
Total	**19**	**14**	**2**	**10**	**9**	**6**	**13**	**4**	**15**

Interview Content

1st. Article- "Participatory Needs Assessment of Small Farmers in Chimaltenango, Guatemala"

After conducting interviews and focus groups, 12 categories were identified:

1. Recent climatic changes
2. Characteristics of intense agricultural systems
3. Characteristics of subsistence agricultural systems
4. Chemical and organic pest management
5. Access to local, national, and international markets
6. Lack of access to inputs and credits
7. Perceptions about innovations
8. Past experiences about agricultural innovations
9. Main needs to improve the farm systems
10. Technical problems in farmers' systems
11. Natural and economical resources
12. Role of gender in the farm

Later these categories were analyzed and combined into 7 categories:

1. Physical factors of the farm
2. Biological factors of the farm
3. Economical conditions of the farm system
4. Social characteristics of the farm system
5. Farmers' knowledge

6. Farmers' beliefs, attitudes and behaviors towards adoption of innovations
7. Farmers' goals

Description of categories

Physical factors. description of major climatic conditions as temperature and seasons. Identification of critical weather conditions. Description of the major types of soil of the region.

Biological factors. description and identification of major factors that affect the health and vitality of plants and animals such as insects, diseases or weeds.

Economical conditions. Description of farmers' access to agricultural inputs for production, credit for farm investment and markets. Description of marketing characteristics including transportation and prices of products in local and national markets.

Social characteristics. Description of land ownership and labor division among gender and age.

Farmers' knowledge. Description of knowledge of farmers about agricultural techniques and animal production.

Farmers' beliefs, attitudes and behaviors towards adoption of innovations. Identification of emotions, reactions and past experiences about adoption of innovations.

Farmers' goals. definitions of farmers' goals and what they want to accomplish in the long run in their farms and communities.

2nd. Article- "A Case Study to Select Opinion Leaders to Diffuse Agricultural Innovations in Chimaltenango, Guatemala"

After doing interviews, 15 categories were identified:

1. Influences to be leader
2. Biggest success as a leader
3. Things learned as a leader
4. Reason to be considered a leader
5. Techniques to involve others
6. Techniques to diffuse information
7. Criteria to select participants for activities/projects
8. How do you influence others
9. Motivation
10. Past experiences for selecting participants
11. Diffusion strategies used in the past
12. Characteristics of leader vs. followers
13. Training evaluation
14. Influence of training
15. Future plans

Later these categories were analyzed and combined into 6 categories:

1. Personal story as a leader
2. Social networks
3. Characteristics of a leader and techniques to influence other

4. Training evaluation (content, application, skills and knowledge)
5. Adoption rate and diffusion of techniques

Description of the categories

Personal story. This category includes the description of the social and economical characteristics of the person to understand their role in the community and/or organization.

Social networks. This category names the key players and followers and their role in the diffusion of innovations and information. It also explains the role of relationships in the diffusion process.

Characteristics of a leader and/or follower. This category talks about what are the characteristics that make a successful leader to influence others as well as characteristics of followers and how they are influenced.

Training evaluation. Importance of training, skills and knowledge learned during training.

Adoption rate and diffusion of innovations: applicability and continuity of training, rate of diffusion of technologies to others.

VITA

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EDUCATION

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Program & Training Specialist	January 2007-June 2008
U.S. Peace Corps	Quito Ecuador
Project Manager for Agricultural Development project	March 2005-December 2006
Constructora Norberto Odebrecht	Banos, Ecuador
Independent consultant	June-December 2004
Organic strawberry farm	Ibarra, Ecuador
Intern	August-December 2002
Agro eco tourist Park- PANACA	Quindío, Colombia